

The Species Diversity of the Genus *Piper* from Thailand

ARUNRAT CHAVEERACH¹, RUNGLAWAN SUDMOON², TAWATCHAI TANEE³
and PIYA MOKKAMUL¹

¹Department of Biology, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand; ²Department of Biochemistry, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand; ³Faculty of Environment and Resource Studies, Maharakham University, Maharakham 44000, Thailand

Species diversity of the genus *Piper* from Thailand was explored based on the herbarium specimens kept at the BK and compared with the specimens deposited in the BCMU, BK, BKF, NY, PE and SING. Taxonomic keys available in the flora of neighboring countries together with other taxonomic literatures were used for botanical identification. From the investigation, forty species of this genus were identified. Of these, two new species are described: *P. maculaphyllum* and *P. rubroglandulosum*. Four species: *P. betloides*, *P. dominantinervium*, *P. pilobracteatum* and *P. phuwaense*, in addition with two varieties: *P. pedicellatum* var. *eglandulatum* and *P. thomsonii* var. *trichostigma* recently reported are included. The other thirty two species recognized are *P. argyritis*, *P. betle*, *P. boehmeriifolium*, *P. caninum*, *P. colubrinum*, *P. hongkongense*, *P. khasianum*, *P. laetispicum*, *P. lolot*, *P. longum*, *P. magnibaccum*, *P. montium*, *P. mullesua*, *P. muricatum*, *P. mutabile*, *P. nigrum*, *P. pedicellatum*, *P. pendulispicum*, *P. politifolium*, *P. polysyphorum*, *P. retrofractum*, *P. ribesioides*, *P. sarmentosum*, *P. semiimmersum*, *P. submultinerve*, *P. sylvaticum*, *P. sylvestre*, *P. thomsonii* var. *thomsonii*, *P. tricolor*, *P. wallichii*, *P. wangii*, *P. yinkiangense*; along with two unknown species: *Piper* sp. 1 and *Piper* sp. 2 which may represent new taxa, will be further studied.

Keywords: New species, *Piper*, Piperaceae, Species diversity, Thailand

The genus *Piper* is estimated to consist of over 1000 species, distributed mainly in tropical regions of the world. Several species have great economic and cultural importance including *P. nigrum*, *P. betle*, *P. methysticum*, etc. Many species have been used for foods, medicines, stimulants, antiseptics and antioxidants in Thai culture (Picheansoonthon *et al.* 2001).

Our taxonomic accounts on this genus are based on the stamen and stigma numbers and characters, floral bract morphology, leaf shape, and leaf venation (Y. C. Tseng *et al.* 1999, Jaramillo & Manos 2001). The identification followed many references: Aghard 1981, Backer

et al. 1963, Brown 1884a, b, Candolle 1910a, b, Chaveerach 2003, Chaveerach & Picheansoonthon 2004, Chaveerach *et al.* 2002, 2006a, b, 2007, Y. C. Tseng *et al.* 1999, Chew 1972, 2003, Gardner 2003, Gilbert & Xia 1999, Henderson 1959, Heyne 1987, Ho 1999, Hooker 1885, Huber 1988, Keng 1990, Lin & Lu 1996, Long 1984, Merrill 1912, Quisumbing 1930, Ridley 1920, 1967, Roxburgh 1820), Royen 1982, Tawan *et al.* 2002, Tebbs 1982 and Yuncker 1972. Moreover, there are some reports taking molecular techniques into account to differentiate *Piper* species (Chaveerach *et al.* 2002, Chaveerach 2003). Recently, 15 *Piper* species were presented (Chaveerach & Pichean-

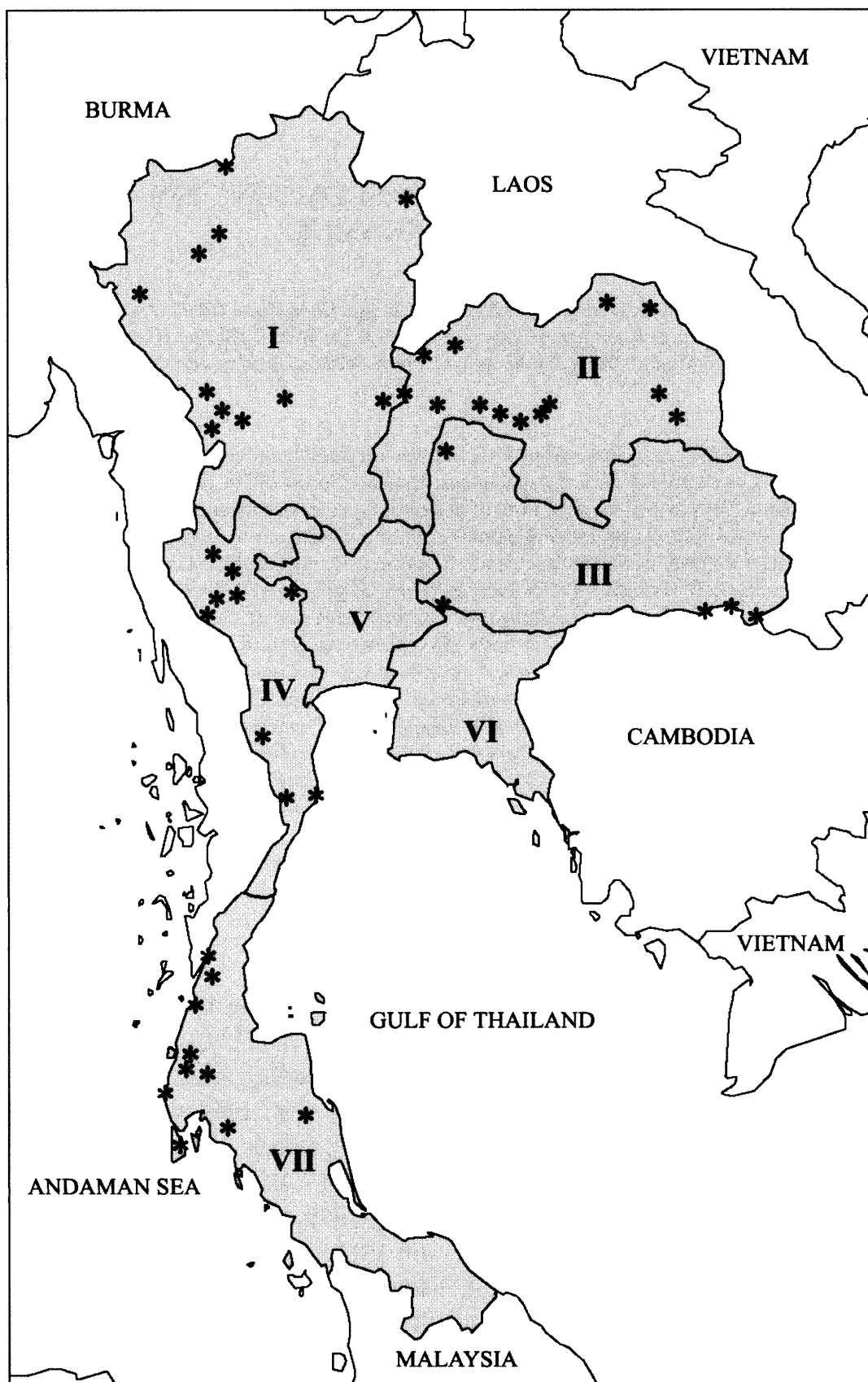


FIG. 1. The seven floristic regions of Thailand: Northern (I), North-eastern (II), Eastern (III), South-western (IV), Central (V), South-eastern (VI) and Peninsula (VII) (Smitinand & Larsen 1972), and sites of investigation (*).

soonthon 2004). Moreover, we have also studied the ethnobotany of the genus *Piper* in Thailand (Chaveerach *et al.* 2006a).

We have investigated the genus *Piper* for over ten years based on field and herbarium studies. Taxonomic identifications were investigated based on references available. The investigation has covered almost all area of the country. Figure 1 shows the seven floristic regions of Thailand according to Smitinand & Larsen (1972) and the sites of our investigations. A total of specimens

deposited in the BCMU, BK, BKF, NY, PE and SING have been studied. Usage of morphological terms in this study is provided in Fig. 2. As the result, currently, a total of 40 species are described and illustrated. Of these, 32 species are recognized, four new species and two new varieties recently reported (Chaveerach *et al.* 2006b, 2007) are included. In addition, two new species, *P. maculaphyllum* Chaveer. & Sudmoon and *P. rubroglandulosum* Chaveer. & Mookamul, are firstly described in this publication

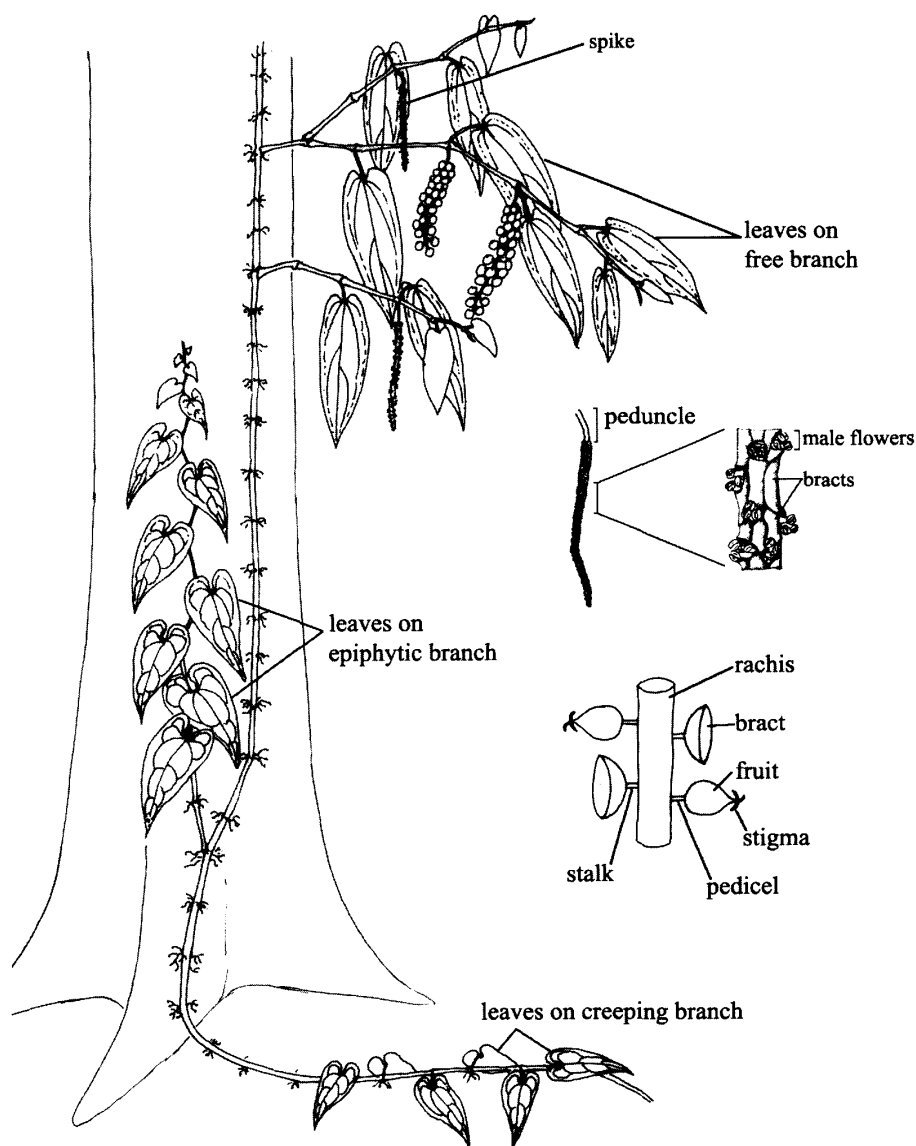


FIG. 2. Usage of morphological terms.

Key to species of the genus *Piper* in Thailand

- 1A. Spike straight up
 - 2A. Small shrubs
 - 3A. Fruiting spikes 8–16 cm long, drupes arranged loosely *P. sylvestre*
 - 3B. Fruiting spikes 1–1.5 cm long, drupes arranged densely *P. sarmentosum*
 - 2B. Climbers
 - 4A. Bracts hairy adaxially *P. pilobracteatum*
 - 4B. Bracts not hairy adaxially
 - 5A. Plants dioecious
 - 6A. Leaf blade thin, ovate to lanceolate or narrowly ovate; base often slightly unequal or cuneate *P. caninum*
 - 6B. Leaf blades membranous, ovate to circular; base cordate with rounded lobes *P. sylvaticum*
 - 5B. Plants monoecious
 - 7A. Stigmas 3–4 on a spike *P. mullesua*
 - 7B. Stigmas 3 on a spike
 - 8A. Fruiting spikes 0.7–2.5 cm long; drupes globose, green when ripen *P. longum*
 - 8B. Fruiting spikes 3.5–6 cm long; drupes globose, red when ripen *P. retrofractum*
 - 1B. Spike pendulous
 - 9A. Leaves on epiphytic branches, adaxially dark pink dapple, abaxially green *P. maculaphyllum*
 - 9B. Leaves on epiphytic and free branches both sides or a side pinkish-light green, light green or green
 - 10A. Plants all parts hairy
 - 11A. Small shrubs *P. muricatum*
 - 11B. Climbers
 - 12A. Leaf blades ovate; base cordate with unequal lobes *P. yinkiangense*
 - 12B. Leaf blades ovate-lanceolate, ovate-oblong, oblong; base oblique, rounded or subcordate with lobes divergent or overlap each other
 - 13A. Stamens 3 *P. hongkongense*
 - 13B. Stamens 2
 - 14A. Leaf blades ovate-lanceolate, ovate-oblong; base oblique, rounded or subcordate with lobes divergent or overlap each other; veins 7, two pairs basal *P. semiimmersum*
 - 14B. Leaf blades oblong; base deeply cordate to auriculate or overlapping auriculate; veins 9, three pairs basal *P. submultinerve*
 - 10B. Plants glabrous or some parts hairy
 - 15A. Fruits with stipe
 - 16A. Stamens 4 *P. ribesioides*
 - 16B. Stamens 2 *P. politifolium*
 - 15B. Fruits sessile or stipe not seen
 - 17A. Bracts with conspicuous stalk, protruding stick out of rachis *P. pedicellatum*
 - 17B. Bract without stalk or without conspicuous stalk
 - 18A. Small shrubs *P. boehmeriifolium*
 - 18B. Climbers
 - 19A. Leaves finely pubescent or densely glands
 - 20A. Leaves abaxially finely pubescent along veins, veins 5, all basal *P. lolot*
 - 20B. Densely brownish-red glands along veins, veins 7, two pairs basal, a pair arising 2–4.5 cm apart from base, opposite or alternate *P. thomsonii*
 - 20C. Leaves abaxially and adaxially densely scattered white glands *P. betloides*
 - 20D. Leaves adaxially densely scattered reddish glands *P. rubroglandulosum*

- 19B. Leaves abaxially not as above
 - 21A. Bracts divided into areas; center black, surrounded by yellow margin *P. tricolor*
 - 21B. Bracts not divided into areas
 - 22A. Bract bases adnate to rachis; stamens 3, male flowers sparsely scattered on rachis, filament flat, longer than anther, raising the anther up above bract *P. polysiphonum*
 - 22B. Bract bases not adnate to rachis
 - 23A. Ovary arising from hole of rachis *P. khasianum*
 - 23B. Ovary not arising from hole of rachis
 - 24A. Bract margin ciliate
 - 25A. Stamens 2 *P. dominantinervium*
 - 25B. Stamens 3
 - 26A. Stem node stout and dilated *P. colubrinum*
 - 26B. Stem neither node stout nor dilated
 - 27A. Male spike 7–10 cm long *P. laetispicum*
 - 27B. Male spike 2–3 cm long *P. phuwaense*
 - 24B. Bract margin not ciliate
 - 28A. Plants monoecious
 - 29A. Male and female flowers on a spike *P. nigrum*
 - 29B. Male and female flowers on separate spikes
 - 30A. Stamens 3 *P. wallichii*
 - 30B. Stamens 2 *P. magnibaccum*
 - 28B. Plants dioecious
 - 31A. Leaf blades with pale or white spots *P. argyritis*
 - 31B. Leaf blades without spots
 - 32A. Veins 5–7
 - 33A. Leaf blades elliptic *P. montium*
 - 33B. Leaf blades narrowly ovate to ovate *P. mutabile*
 - 32B. Veins 6–7, 7 or 7–9
 - 34A. Stigmas 4–6 *P. betle*
 - 34B. Stigmas 3–4
 - 35A. Female spikes 10–20 cm long *P. pendulispicum*
 - 35B. Female spikes 1–2 cm long *P. wangii*

Enumeration of Species

1. *Piper argyritis* Ridl. ex C. DC., Rec. Bot. Surv. Ind. 6: 25 (1912). (Fig. 3)

Dioecious, stout climber, node slightly dilated. Petiole 1–1.5 cm long; leaf blade thick chartaceous, glabrous, light to dark green, pale or white spots easily seen when dried, oblong-ovate, 4.5–5.5 cm wide, 12–15 cm long; apex acuminate; base oblique, slightly cuneate to rounded; veins elevating beneath, one or two pairs basal, the others arising from midrib at regular interval. Male

spike pendulous, 6–8 cm long, 0.2–0.3 cm in diameter; peduncle 1.2–1.5 cm long; bract orbicular, abaxially pubescent, adaxially convexed; filament flat; stamens 2. Flowering on year round.

Local name. Sa-kan, Sa-kan-hin, Sa-kan-dook.

Distribution. Northern Thailand, 800–900 m alt.

Specimens examined. THAILAND: Northern, Chiang Mai province, cultivated in villages, 900 m alt.,

October 12, 1998, *A. Chaveerach* 11 (BK 63490); *Beijing young group* 1467 (PE 680455).

Notes. This species is cultivated in villages for woody stem used in soup, but not as popular as *P. pendulispicum* due to its stem is harder.

2. *Piper betle* L., Sp. Pl. 1: 28 (1753). (Fig. 4)

Dioecious, climber. Stem stout with pinkish-stripe along, node dilated and rooting. Petiole 2–2.5 cm long; leaf blade fleshy coriaceous, glabrous, greenish or yellowish, broadly ovate, 7–8.5 cm wide, 9–11 cm long; apex acuminate; base cordate; veins 7–9, elevating beneath, two or three pairs basal, one pair arising from midrib. Male spike cylindric, slender, pendulous, 3–12 cm long, ca. 0.5 cm in diameter; peduncle 2–3 cm long; bract orbicular, peltate; stamens 2. Female spike cylindric, pendulous, 2.5–4 cm long, ca. 0.5 cm in diameter; peduncle 2–3 cm long; bract orbicular, peltate; stigmas 4–6, pubescent. Fruiting spike 3–5 cm long; drupe embedded on rachis. Flowering and fruiting on year round.

Local name. Plu.

Distribution. Whole Thailand to China, Indonesia, Malaysia, Philippines, Sri Lanka, Vietnam, Madagascar.

Specimens examined. THAILAND: North-eastern, Khon Kaen province, 200 m alt., October 22, 1998, *A. Chaveerach* 16 (BK 63494); *Qi-wu Wang* 75416 (PE 200005554); *H. N. Ridley SING* 4684 (SING); *Z. Teruya SING* 869 (SING).

Notes. This species is cultivated for traditional medicine. Many Thai people are familiar with this plant because it is always seen in several traditional activities. Its leaf is used for wrapping of betel nut and lime for masticatory.

3. *Piper betloides* Chaveer. & Tanomtong, Acta Phytotax. Geobot. 58(1): 33–35, fig. 1 (2007).

Dioecious, climber, fragrant like *P. betle*. Stem

slender or stout; node of young branch inflated, 0.5–0.7 cm thick. Petiole not sheathed at base, 1.5–2 cm long. Leaf blade leathery thick, with white glands densely scattered on both surfaces, dark green, narrowly ovate to ovate, elliptic or oblong, 5.5–17 cm wide, 11.5–25 cm long; apex acuminate; base obliquely truncate or obliquely rounded; margin entire; veins abaxially prominent, two pairs from the base, four or five pairs arising from midrib. Male spike unknown. Female spike pendulous, white, 2.5–3 cm long, 0.5–0.7 cm in diameter; peduncle 1.5–2 cm long; bract elliptic, shortly stalked, base pubescent; stigma 3–4, hairy. Drupe globose, loosely interrupted on rachis. Flowering and fruiting on May to June.

Local name. Plu-doi-su-thep.

Distribution. Northern Thailand, Hill evergreen forest near water fall, 1100 m alt.

Specimen examined. THAILAND: Northern, Chiang Mai province, Doi Suthep-Pui National Park, 1100 m alt., May 15, 2001, *A. Chaveerach* 47 (BK 63514, 63720).

4. *Piper boehmeriifolium* (Miq.) Wall. ex C. DC. in A. DC., Prodr. 16(1): 348 (1868); Hook. f. in Fl. Brit. Ind. 5: 85 (1885); Ridl., Fl. Malay Pen. 3: 41 (1967); Ho, Illust. Fl. Viet. 1: 293 (1999). – *Chavica boehmeriifolia* Miq., Syst. Piperac.: 265 (1843). (Fig. 5)

Dioecious, slender shrub, up to 2 m tall. Stem warted, internode up to 30 cm long, young stem hairy. Petiole 0.5–1 cm long; leaf blade membranous, lanceolate, 4–7 cm wide, 17–23 cm long; base oblique with unequally auricles; apex acuminate; veins 7–9, one or two pairs basal, the others arising from midrib, alternate, reticulate veins transverse. Male spike 10–16 cm long, 0.2–0.3 cm in diameter; peduncle 1–3.5 cm long; bract orbicular, inserted basally or peltate; stamens 2. Female spike 6–12 cm long, ca. 0.2 cm in diameter; peduncle and bract as in male spike; stigmas

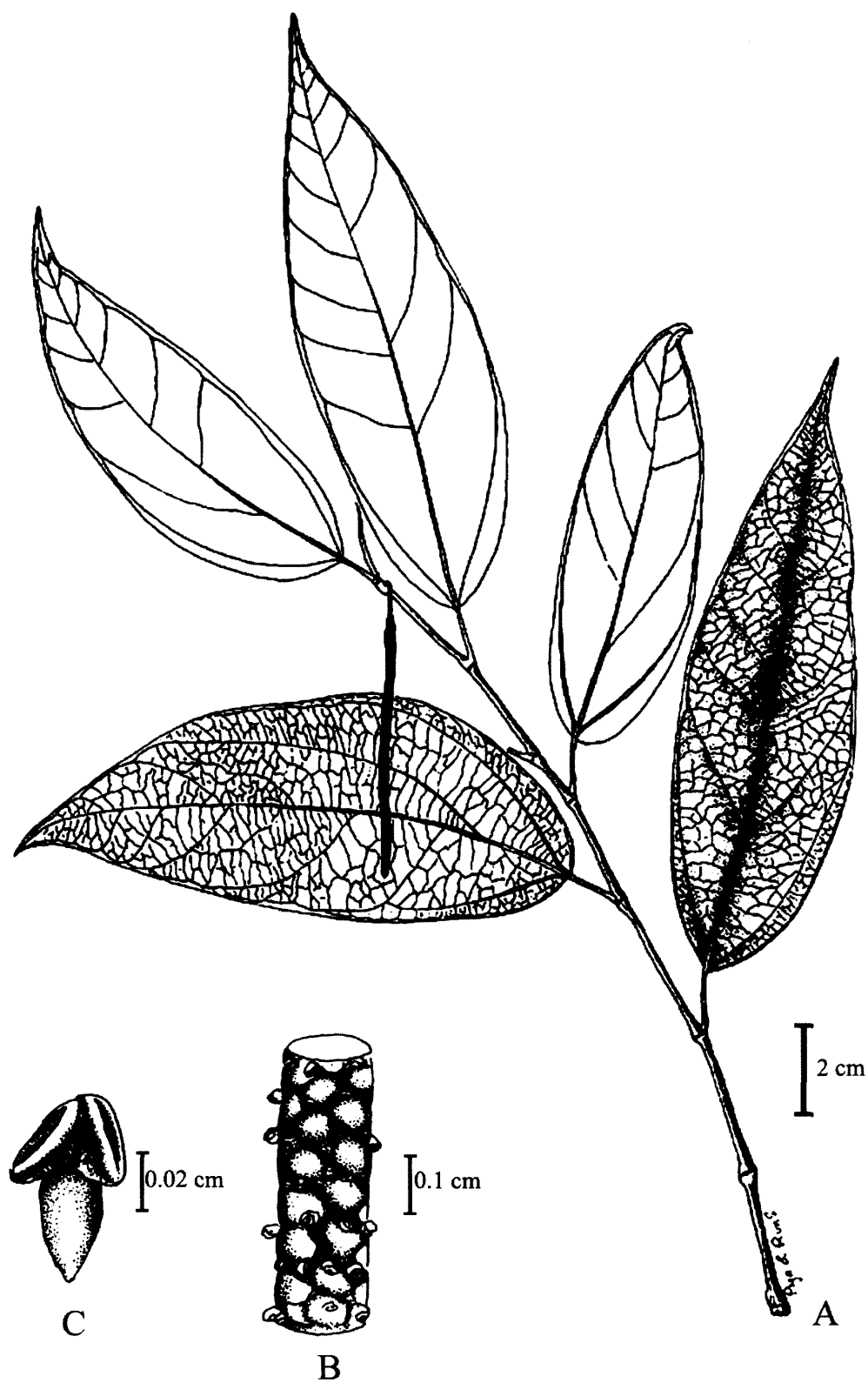


FIG. 3. *Piper argyritis* Ridl. ex C. DC. A: Branch with male spike. B: Part of male spike. C: Male flower. A. Chaveerach 11 (BK 63490).

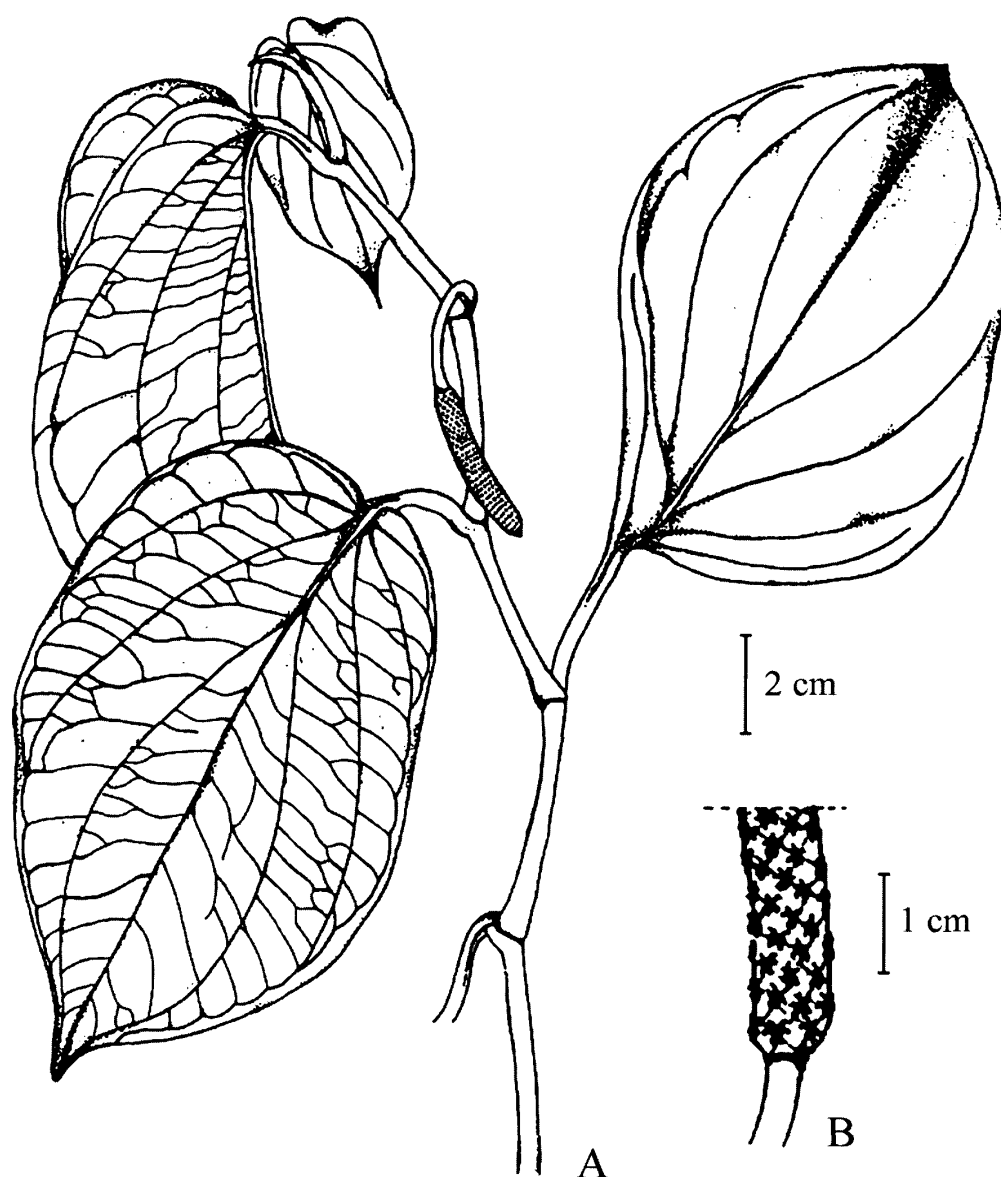


FIG. 4. *Piper betle* L. A: Free branch with female spike. B: Part of female spike. A. Chaveerach 16 (BK 63494).

deciduous. Fruiting spike 6–12 cm long; drupe subglobose, arranged densely on rachis. Flowering and fruiting from November to March.

Distribution. Whole Thailand to Bangladesh, India, Myanmar, China, Bhutan, Malaysia, Sikkim, Vietnam, 100–900 m alt.

Specimens examined. THAILAND: North-eastern, Phu Luang Wildlife Sanctuary, Loei province, 900 m alt., July 9, 1998, A. Chaveerach 2 (BK 63480), September 2, 2004, A. Chaveerach 85 (BK 63480); B.

Nimanong & S. Phusomsaeng SING 269 (SING); J.F. Maxwell BKF 046689 (BKF); Pin-yi Mao 3738 (PE), Qi-xin Liu 26384 (PE 210001662); William BKF 17133 (BKF).

5. *Piper caninum* Blume, Batav. Gen. 11: 214 (1826). (Fig. 6)

Dioecious, slender climber. Stem fragile, glabrous, sparsely short hispid. Petiole slender, fragile, 0.5–1 cm long; leaf blade thin, membranous,

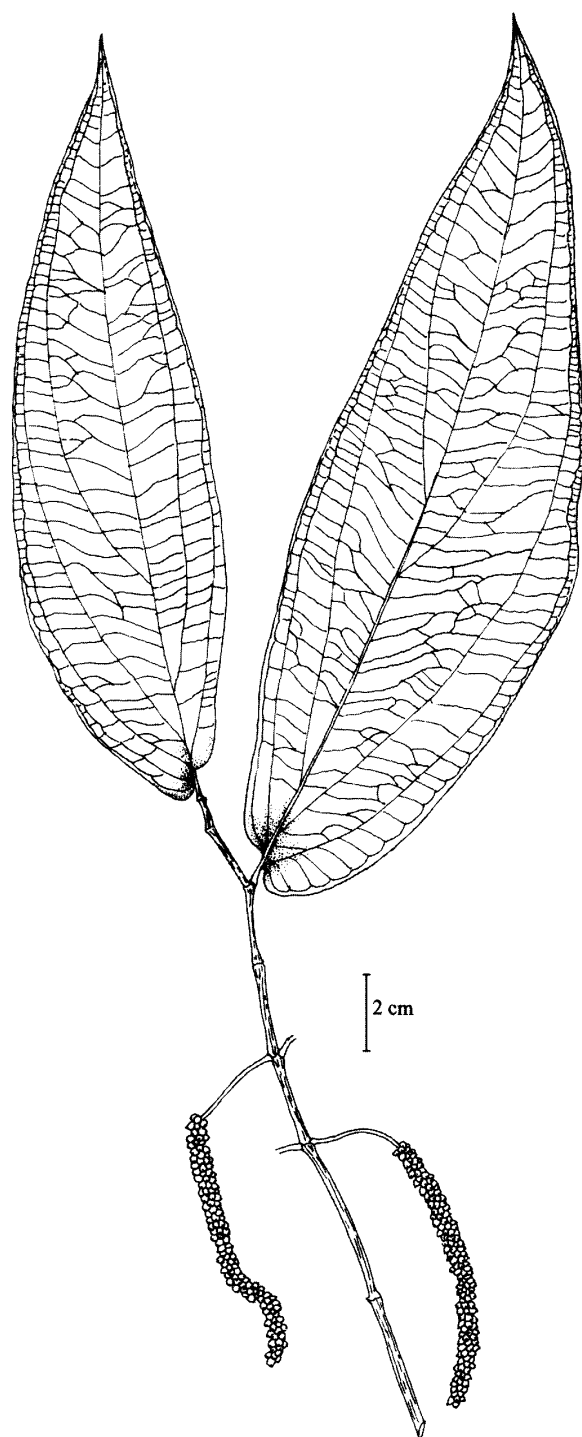


FIG. 5. *Piper boehmeriifolium* (Miq.) C. DC. Branch with fruiting spikes. A. Chaveerach 2 (BK 63480).

variable in shapes and size, ovate to lanceolate or narrowly lanceolate, rather small, 2–4.5 cm wide, 7–8 cm long; apex acuminate; base often slightly unequal or cuneate; veins 3, one pair arising near

base; or veins 5, one pair basal, another pair arising from midrib near base. Male spike straight up, 1.5–3 cm long; peduncle slender, fragile, 0.5–1 cm long; rachis pubescent; bract suborbicular, with not smooth edge; stamens 2, with long filament, exerted from bracts. Flowering from April to October.

Distribution. Southern Thailand to India, Malaysia, 100–600 m alt.

Specimens examined. THAILAND: Peninsula, Khao Maen, Nam Tok Yong National Park, Nakhon Sri Thammarat province, 100 m alt., January 2, 2004, A. Chaveerach 79 (BK); A.F.G. Kerr 11747, 12567, 13312, 13663, 16732, 18347, 18561 (BK); E. J. H. SING 28492 (SING); H. R. Henderson SING 12822 (SING); J. S. Burley SING 3776 (SING); T. Smittinand BKF 1001 (BKF).

6. *Piper colubrinum* Link, Jahrb. 1(3): 61 (1820). (Fig. 7)

Dioecious, scandent, 3–4 m tall. Stem stout joint, node dilated and rooting, 2–3 cm in diameter. Petiole 0.5–1 cm long; leaf blade coriaceous, papery, glabrous, light shiny green, ovate to lanceolate, 7.0–8.5 cm wide, 17–18 cm long; apex acute; base oblique; veins 9, one pair basal, one pair arising 0.3–0.5 cm apart from base, the others arising alternately from midrib with one pair reaching to apex. Male spike pendulous, white cylindric, 4–5 cm long, 0.6–0.7 cm in diameter; peduncle ca. 1 cm long; bract elliptic with edge hairy; stamens 3; Flowering on year round.

Local name. Prik-thai-tua-pu.

Distribution. Whole Thailand.

Specimens examined. THAILAND: North-eastern, Khon Kaen province, 200 m alt., October 22, 1998, A. Chaveerach 19 (BK); J. F. Maxwell BCMU 98-858 (BCM); T. K. Kueh. SING 153 (SING).

Notes. This species is cultivated in lowland garden usually used as a stalk for grafting of *P. nigrum*.

7. *Piper dominantinervium* Chaveer. & Mokkamul, Acta Phytotax. Sin. 44(4): 447–449, fig. 1 (2006).

Dioecious, climber on trees. Stem stout, nodes distinctly joint, swollen, brownish-blackish and furrowed when dried. Leaves on epiphytic branches petiole 1–1.2 cm long; leaf blade coriaceous, oblong to narrowly elliptic, 1.5–3.5 cm wide, 7.5–9 cm long; apex acute; base subcuneate-cuneate or subrounded. Leaves on free branches petiole 0.1–0.2 cm long; leaf blade coriaceous, dark green, densely yellowish, brownish or reddish glands, ovate or narrowly elliptic to elliptic, 2.5–9 cm wide, 12–19 cm long; apex cuspidate; base

oblique with unequal sides, auriculate. Veins different from most *Piper* species, many, all arising from midrib at regular intervals of base to apex reaching near margin and joining with each other. Male spike pendulous, 5–13 cm long, ca. 0.3 cm in diameter; peduncle 0.7–1.5 cm long; bract elliptic, sessile, margin ciliate; stamens 2. Female spike not seen. Flowering from September to November.

Local name. Plu-tum-nang.

Distribution. Southern Thailand.

Specimen examined. THAILAND: Southern, Sri Phang Nga National Park, Phang Nga province, 100 m alt., October 19, 2000, A. Chaveerach 43 (BK 63498, 63499, 63500).

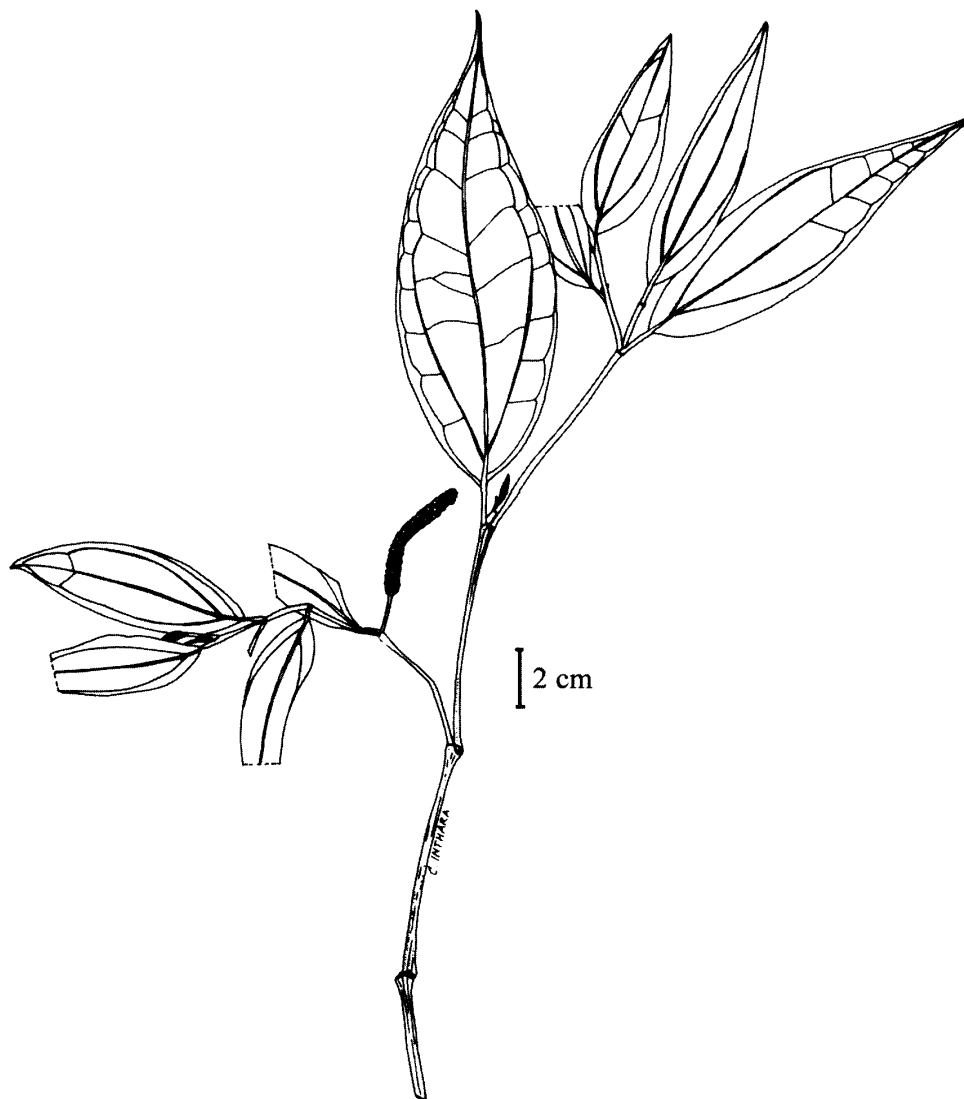


FIG. 6. *Piper caninum* Blume. Free branch with flowering spike. A. Chaveerach 79 (BK).

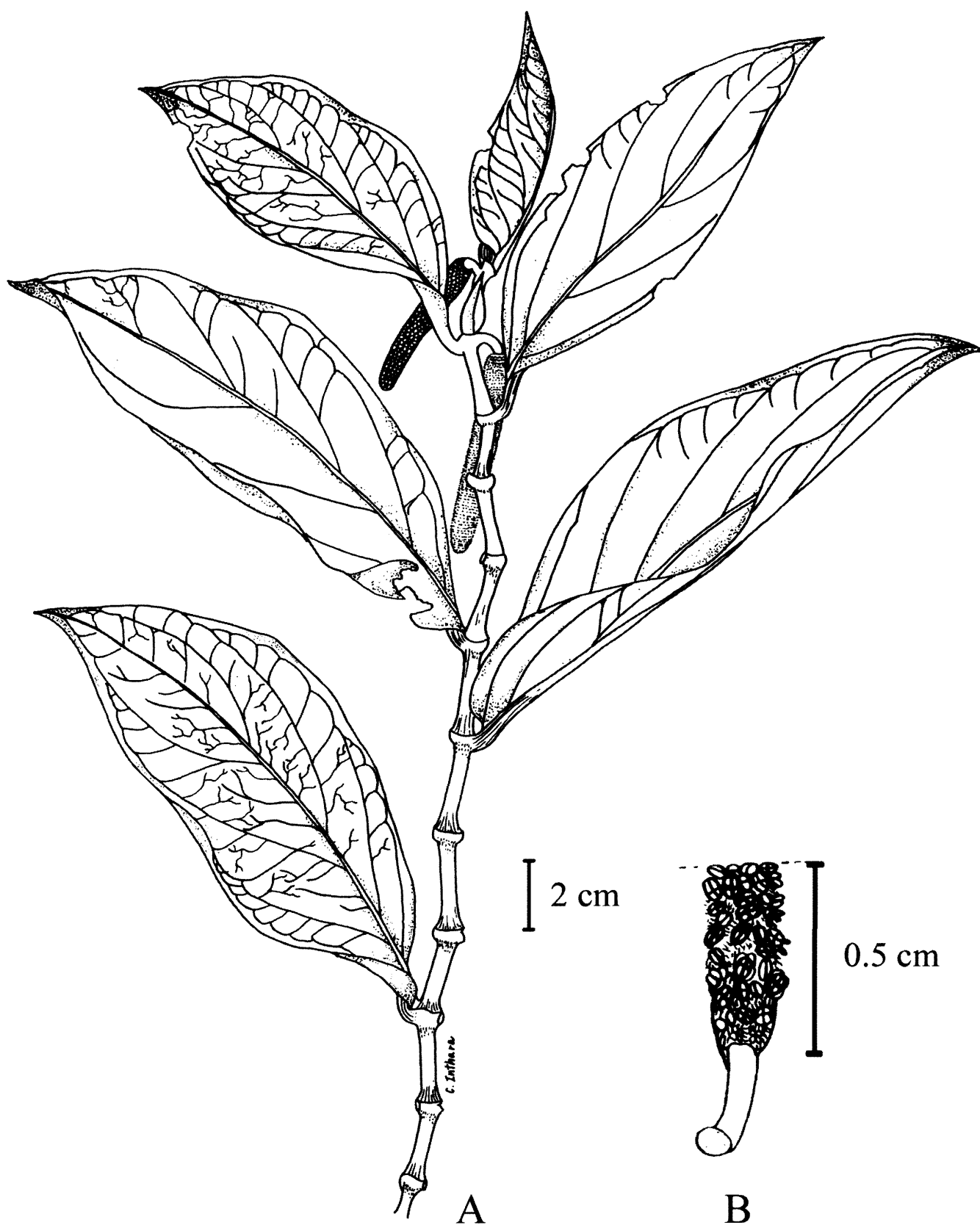


FIG. 7. *Piper colubrinum* Link. A: Branch with male spike. B: Part of male spike. A. Chaveerach 19 (BK).

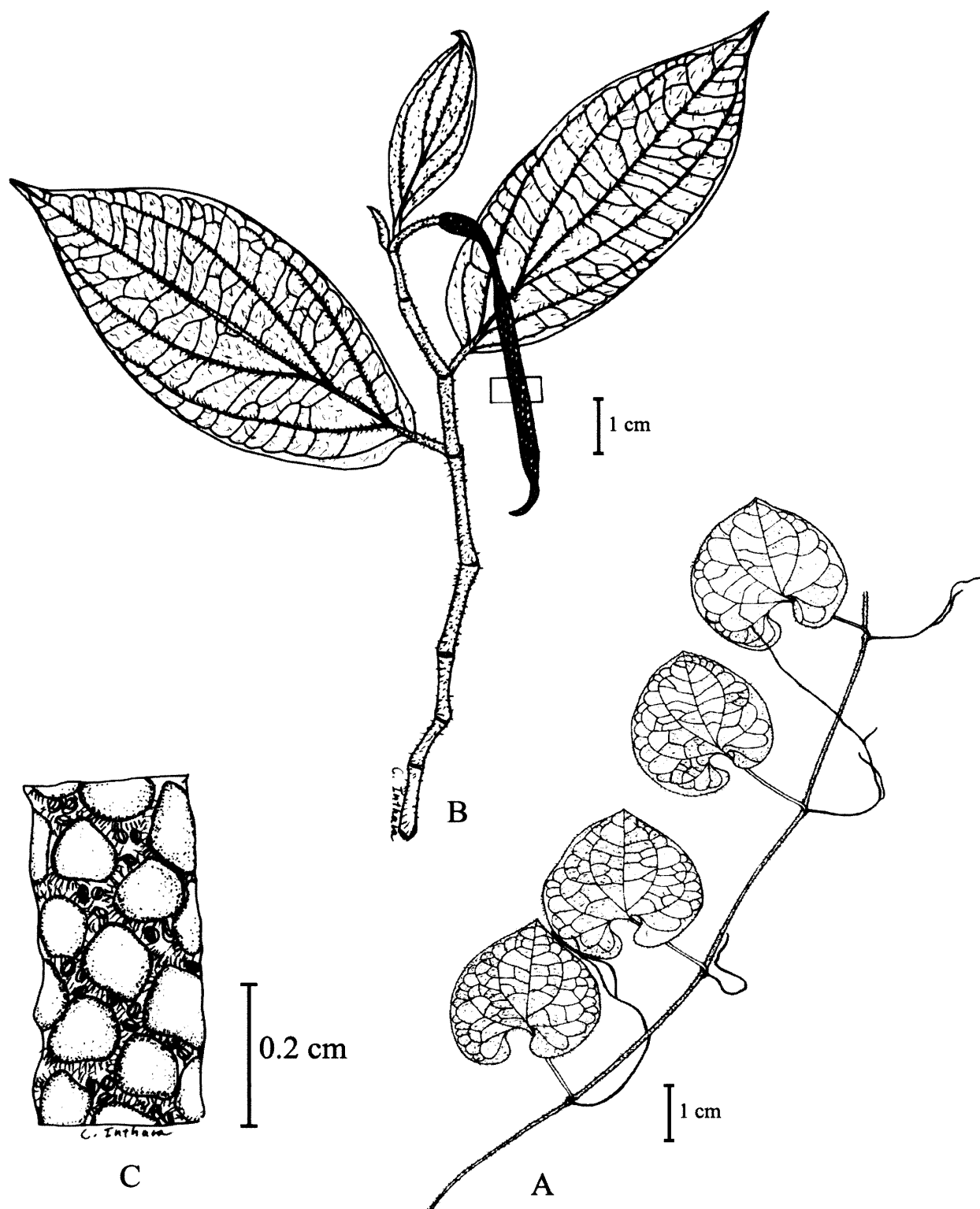


FIG. 8. *Piper hongkongense* C. DC. A: Creeping branch. B: Free branch with spike. C: Part of male spike. A. Chaveerach 68 (BK).

8. *Piper hongkongense* C. DC. in A. DC., Prodr. 16(1): 347 (1869); Y. C. Tseng *et al.* in Fl. China 4: 121 (1999). (Fig. 8)

Chavica puberula Benth., Fl. Hongk.: 35 (1872). – *P. puberulum* (Benth.) Maxim., Bull. Acad. Imp. Sci. Saint-Pétersbourg, ser. 3, 31: 94 (1887), teste Y. C. Tseng *et al.* (1999).

Dioecious, slender climber, all parts hairy, rooting at nodes. Leaves on creeping branch petiole 3–5 cm long; leaf blade membranous, densely hairy on both surfaces, ovate or rounded; apex short acuminate; base cordate, with sinus widely. Leaves on epiphytic branches petiole 2–3 cm long; leaf blade membranous, hairy on both surfaces but not as dense as those in leaves on creeping branch, ovate; apex short acuminate; base deeply cordate, rounded lobes. Leaves on free branches petiole 0.5–1 cm long; leaf blade membranous, hairy on both surfaces but not as dense as those in leaves on epiphytic branches, narrowly ovate or elliptic; apex short acuminate; base cuneate or oblique. Leaf blade 3–6 cm wide, 9–12 cm long; veins 7, one pair basal, two pairs arising from midrib, reticulate veins conspicuous. Male spike 10–25 cm long, ca. 0.5 cm in diameter; peduncle 1–1.5 cm long; bract deltoid, edge of lower surface ciliate; stamens 3. Flowering around April.

Distribution. North-eastern Thailand to China, 900–1500 m alt.

Specimen examined. THAILAND: North-eastern, Phu Luang Wildlife Sanctuary, Loei province, 900 m alt., December 25, 2003, *A. Chaveerach* 68 (BK).

9. *Piper khasianum* C. DC. in A. DC., Prodr. 16(1): 349 (1869); Hook. f., Fl. Brit. Ind. 5: 89 (1885); Long in Grierson & Long, Fl. Bhutan 1(2): 350 (1984); Ho, Illust. Fl. Viet. 1: 296 (1999). (Fig. 9)

Slender climber often on rocks and trees, glabrous, not fragrance. Petiole 1–1.5 cm long; leaf blade coriaceous, finely pellucid glands, narrowly

elliptic to elliptic or narrowly ovate to broadly ovate, 5–10 cm wide, 13–16 cm long; apex acuminate; base oblique or rounded; veins 7–9, abaxially prominent, two or three pairs basal, one pair arising 1.5–3 cm apart from base, opposite or alternate, reaching leaf apex, reticulate veins not conspicuous. Female spike 8–17 cm long; peduncle 1–3 cm long; bract oblong, base adnate to rachis, tip free; ovary rising up from rachis; stigmas 2–3 or 3–4 depending on different individual plants and areas. Fruiting spike 8–17 cm long; drupe globose, 0.2–0.3 cm in diameter, arranged loosely on rachis. Flowering and fruiting from September to November.

Distribution. North-eastern Thailand to India, Sikkim, Assam, 100–1100 m alt.

Specimen examined. THAILAND: Central, Nang-rong waterfall, Khao Yai National Park, Nakhon Nayok province, 300 m alt., October 24, 2004, *A. Chaveerach* 149 (BK).

10. *Piper laetispicum* C. DC., Notul. Syst. Paris 3: 42 (1914). (Fig. 10)

P. maclurei Merr., Philipp. J. Sci. 21: 339 (1922); Y. C. Tseng *et al.* in Fl. China 4: 117 (1999).

Dioecious, climber, glabrescent. There are clarified variations of morphological characters, therefore, male and female plants are separately described. Male plants: stem ridged, sparsely short hairy to glabrous, pale when dried. Petiole pubescent, 1–5 cm long; leaf blade leathery, adaxially pellucid dotted, oblong or occasionally elliptic, 2–6 cm wide, 9–18 cm long; apex short acuminate; base truncate, shallowly cordate or semiauriculate when mature; veins abaxially pubescent, one pair basal, one pair arising 0.5–2 cm apart from base, the others short and conspicuous, arising from midrib above the second pair. Spike 7–10 cm long, 0.2–0.4 cm in diameter; peduncle 0.8–1.2 cm long; bract obovate, peltate, margin ciliate; stamens 3. The male plant is very similar to *P.*

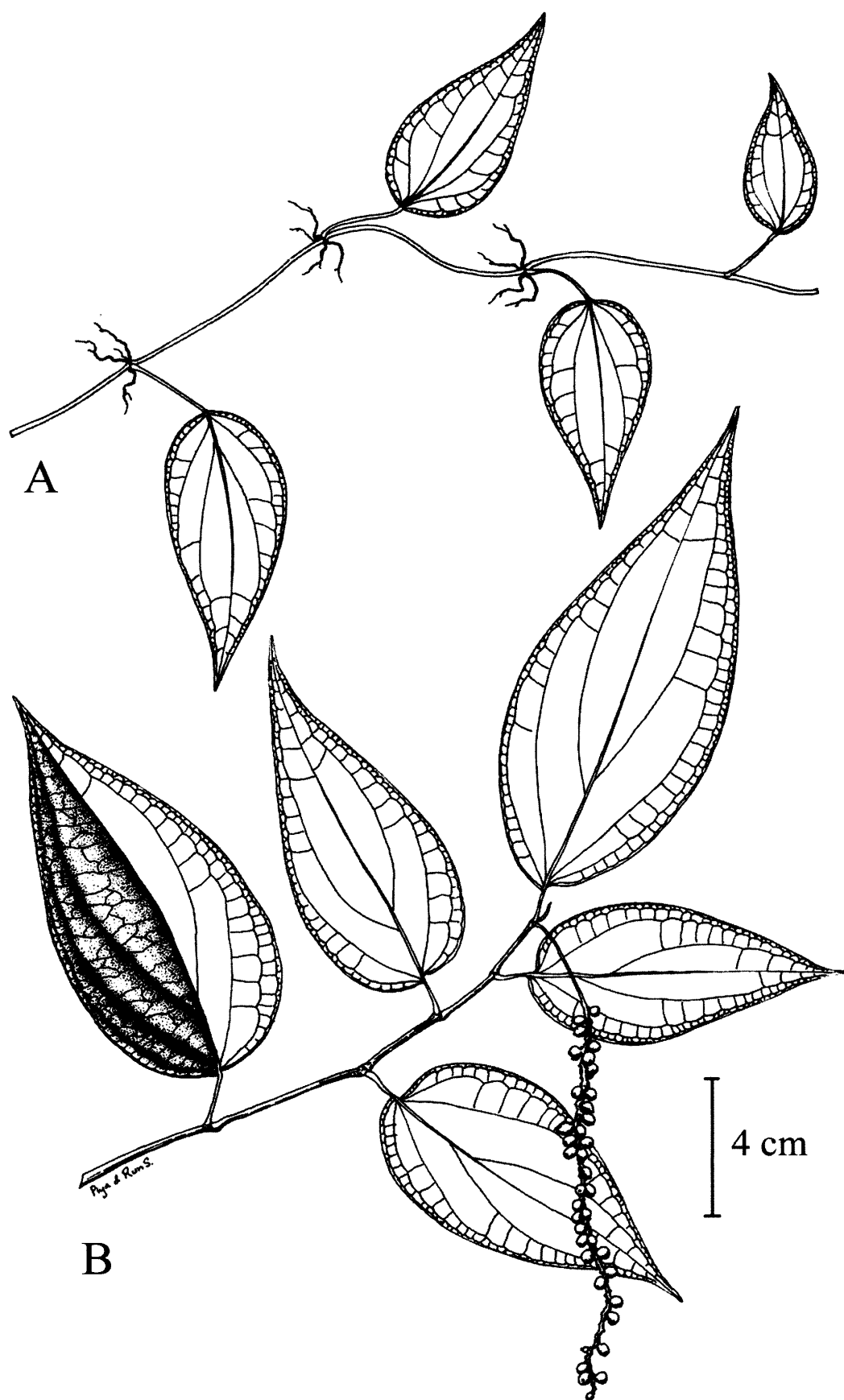


FIG. 9. *Piper khasianum* C. DC. A: Epiphytic branch. B: Free branch with fruiting spike. A. Chaveerach 149 (BK).

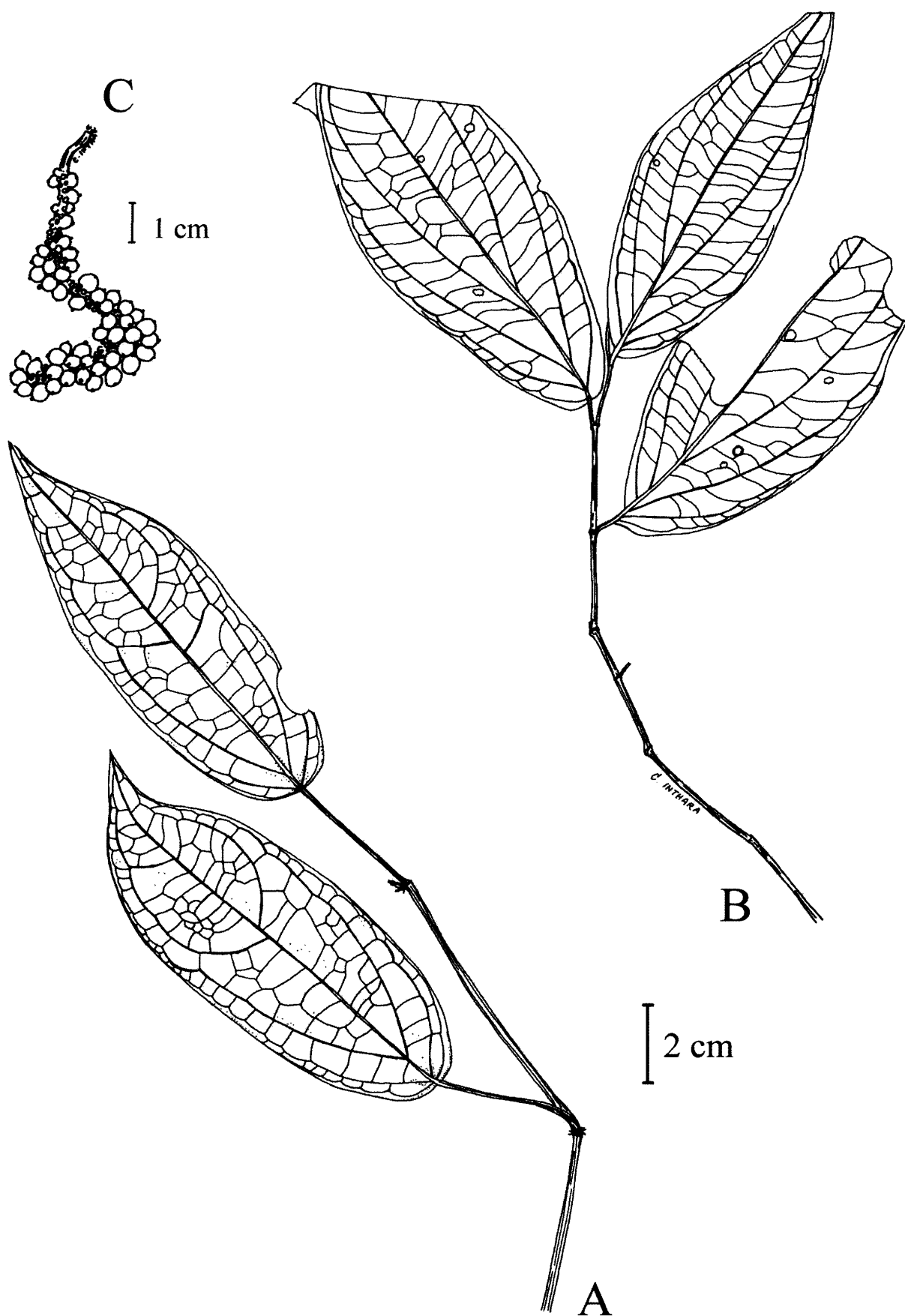


FIG. 10. *Piper laetispicum* C. DC. A–B: Free branches. C: Fruiting spike. A. Chaveerach 70 (BK).

politifolium. Female plants: main stem and abaxial veins densely villous, adaxial veins glabrous; branch slightly villous or glabrous. Petiole 0.5–1 cm long; leaf blade membranous, dark green, elliptic, 3–7 cm wide, 10–15 cm long; apex short acuminate; base semiauriculate, unequal lobes, sometimes overlap each other; veins 8–9, at one lobe 3 or 4, at the other lobe 4; two prominent pairs basal, one pair arising 1–2 cm apart from base, reticulate veins prominent. Spike 8–10 cm long, 0.2–0.5 cm in diameter; peduncle 0.8–1.2 cm long; bract as in male spike; stigmas 4. Fruiting spike 7–12 cm long; drupe globose, pubescent, berry and dark green when ripen. Flowering from August to December.

Distribution. Northern Thailand to China, 100–600 m alt.

Specimens examined. THAILAND: Northern, Doi Phu Kha National Park, Nan province, 1200 m alt., December 26, 2003, *A. Chaveerach* 70 (BK); *Hainan east group* 323 (PE); *Liang Deng* 2076 (PE 200005572).

11. *Piper lolot* C. DC., *Annuaire Conserv. Jard. Bot. Genève* 2: 272 (1898). (Fig. 11)

Creeping on ground and then stem erect, 30–40 cm high. Petiole 2–4.5 cm long; leaf blade adaxially glabrous, abaxially finely pubescent along veins, ovate, 3–6 cm wide, 4.5–10 cm long; apex acute; base cordate; veins 5, all basal. Spikes not seen.

Distribution. North-eastern, Northern Thailand to Vietnam, 500–1200 m alt.

Specimen examined. THAILAND: North-eastern, Huay Huad National Park, Sakon Nakhon province, 500 m alt., December 26, 2003, *A. Chaveerach* 74 (BK, BKF 077189).

Note. Spike has not been seen in the species, but creeping and erect stem, dominant leaf shape and finely pubescent on veins of lower surface indicate that it is *P. lolot*.

12. *Piper longum* L., *Sp. Pl.* 1: 29 (1753). (Fig. 12)

Monoecious, climber, many parts finely powdery pubescent when young. Stem often flexuous. Petiole 1–3 cm long. Leaves on creeping branch and epiphytic branches blade ovate or elliptic. Leaves on free branches blade ovate to ovate-oblong. Leaf blade membranous, dark green, 3–5 cm wide, 7–10.5 cm long; apex acuminate; base cordate or oblique; veins 5, one pair basal, one pair arising 1.5 cm apart from base, opposite or alternate. Male spike straight up, 5–8 cm long, 0.3–0.7 cm in diameter; peduncle 0.5 cm long; bract orbicular, stalked; stamens 2. Female spike straight up, 0.6–2 cm long, ca. 0.2 cm in diameter; peduncle 0.5 cm long; bract circular, peltate; stigmas 3. Fruiting spike straight up, 0.7–2.5 cm long; drupe globose, sessile, arranged densely on rachis. Flowering from May to September.

Local name. Dipli, Prik-hang, Sa-kan.

Distribution. North-eastern, Central Thailand to China, India, Nepal, Assam, Sri Lanka, Bengal, Malaysia, 200–1050 m alt.

Specimens examined. THAILAND: North-eastern, Bung Khonglong Non-hunting Area, Nong Khai province, 300 m alt., July 9, 1998, *A. Chaveerach* 3 (BK 63481), October 29, 1998, *A. Chaveerach* 10 (BK 63489); *A.F.G. BK 4588* (BKF); *Chun-yu Yang et al. 4802* (PE 200005574); *H. N. Ridley SING 399* (SING); *J. F. Maxwell BKF 112601, 95-527, 96-1523* (BKF).

13. *Piper maculaphyllum* Chaveer. & Sudmoon, sp. nov. (Figs. 13, 14)

Haec species *P. ornato* N. E. Br. similis, sed differt caulibus robustis pilosis pilis brevibus albis, foliis ramorum scandentium ovatis vel late lanceolatis basi cordatis petiolo 2–5 cm longo dense piloso pilis brevibus albis, foliis ramorum liberorum utrinque viridibus sparse glandulosis glandulis pellucidis subfusco-rufis basi subrotundatis vel subcordatis cum lobis rotundatis unequalibus aliquando superpositis.

Typus. THAILAND. Peninsula: Phuket province;

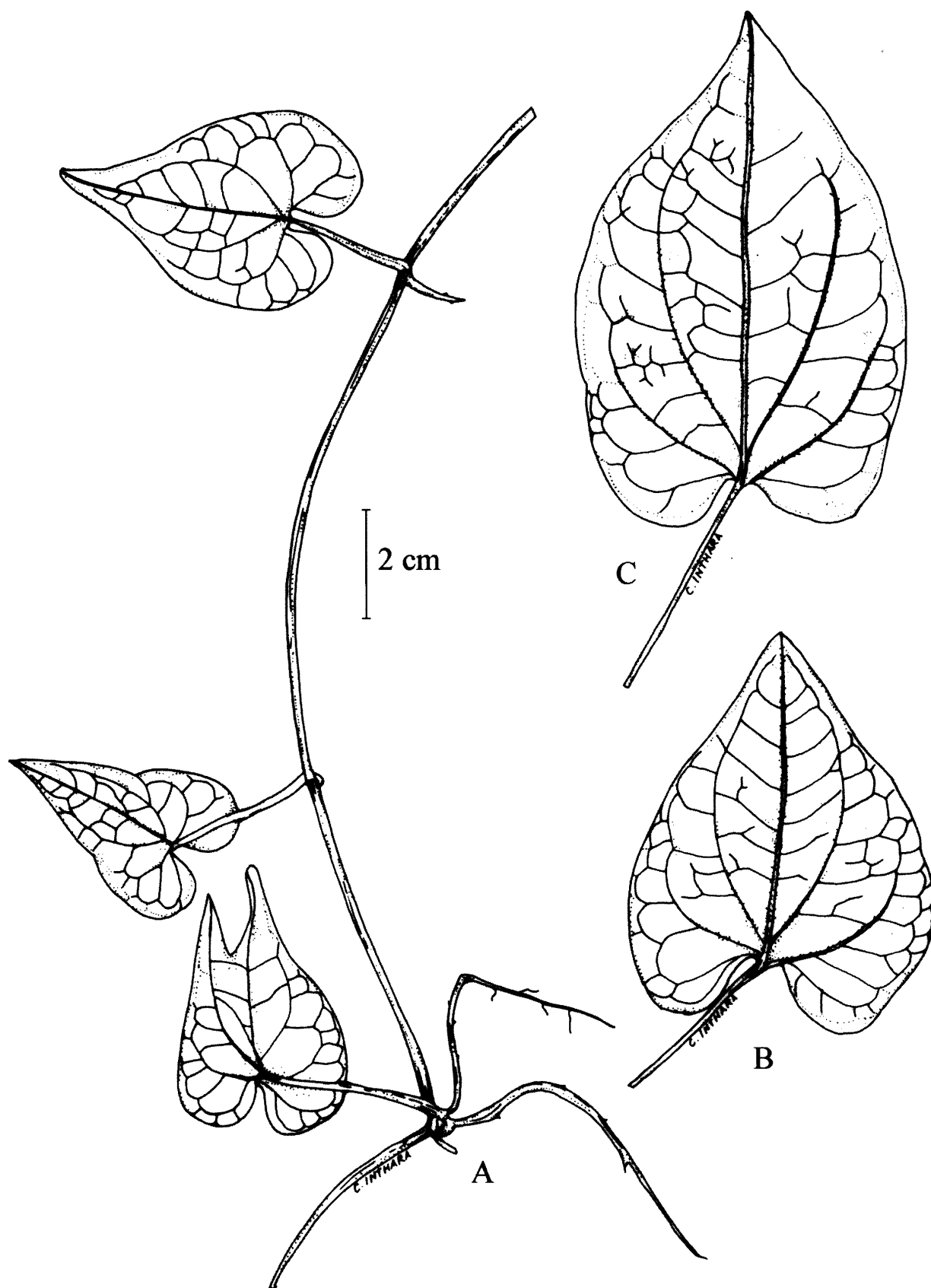


FIG. 11. *Piper lolot* C. DC. A: Creeping branch. B: Leaf on epiphytic branch. C: Leaf on free branch. A. Chaveerach 74 (BKF 077189).

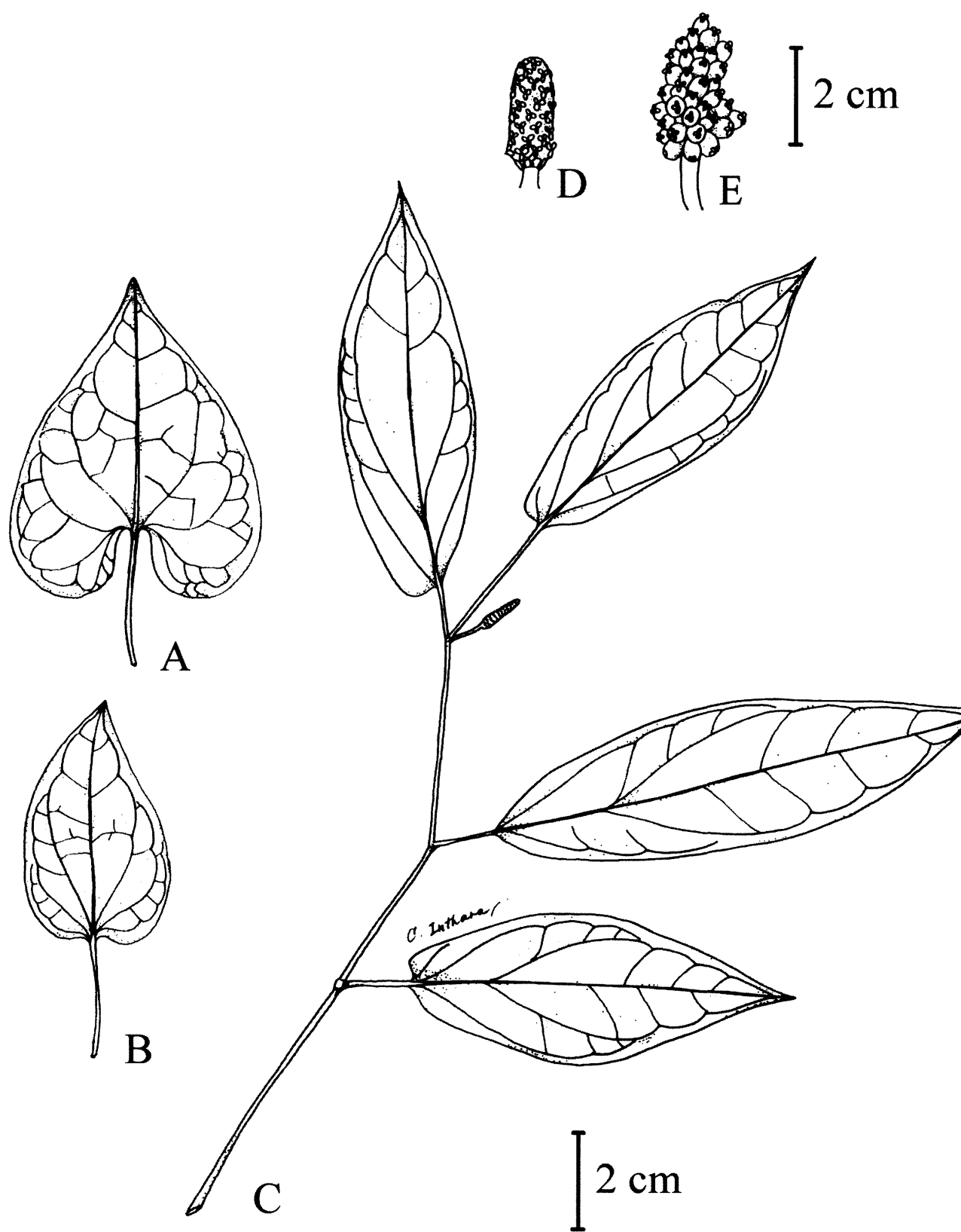


FIG. 12. *Piper longum* L. A: Leaf on creeping branch. B: Leaf on epiphytic branch. C: Free branch with spike. D: Female spike. E: Fruiting spike. A. Chaveerach 3 (BK 63481).

Khao Phra Thaeo Wildlife Conservation Development and Extension Center, altitude of 100–200 m, 19 Oct 2004, *A. Chaveerach* 126 (holo- BK [BK63815]; iso- BKF).

Monoecious, climbing on trees. Stem stout, with white short hairs, furrowed when dried. Petioles densely white-short hairs, 2–5 cm long. Leaves on epiphytic branches: leaf blade thick leathery, adaxially light green to dark pink dapple, abaxially green, ovate to broadly lanceolate, 7–15 cm wide, 20–22 cm long; apex acuminate; base cordate. Leaves on free branches: leaf blade thick leathery, with scattered pellucid and brownish-red glands, shape and size as same as leaves on epiphytic branches; apex acuminate; base subrounded or subcordate with rounded and unequal lobes, basal lobes sometimes overlapping, both sides glabrous. Veins 7–9, apical pair arising 1–3 cm apart from base, often alternate, reaching leaf apex, others basal, reticulate veins conspicuous, abaxially pink prominent. Flower unisexual. Male spike pendulous, ca. 2 cm long, 0.2 cm in diameter; peduncle ca. 1 cm long; bract elliptic, peltate, stalk short and hairy, margin ciliate; stamens 2, with flat and unequal filament long. Female spike similar to male spike, 2–8 cm long; stigmas 4. Fruiting spike 2–10 cm long, 0.4–1 cm in diameter; peduncle 1.2–2.2 cm long; drupe hairy, partly connate to rachis. Flowering and fruiting from August to November.

Local name. Plu-long-ya.

Distribution. Southern Thailand, Moist evergreen forest, near waterfalls and streams, 100–200 m alt.

Other Specimens examined. THAILAND: Southern, Lam Nam Kraburi National Park and Ngao Waterfall National Park, Ranong province, 100–200 m alt., October 20, 2004, *A. Chaveerach* 127 and 128 (BK); Southern, Khao Luk-Lumru National Park, Phang Nga province, 100–200 m alt., October 21, 2004, *A. Chaveerach* 129 (BK); Southern, Khlong Phanom National Park, Surat Thani province, 100–200 m alt.,

October 23, 2004, *A. Chaveerach* 130 (BK); Southern, Khao Luang National Park, Nakhon Sri Thammarat province, 100–200 m alt., October 24, 2004, *A. Chaveerach* 131 (BK).

Notes. The specific epithet of this new species is named by its colorful epiphytic leaf that to be in accord with its Thai vernacular name “Plu-long-ya”. The word “Plu” is from the Thai vernacular name of *P. betle* L. due to having similar fragrance to *P. betle* L., “Long-ya” in Thai, means to make beautiful gold dapples. Therefore, this new species shows similar fragrance to *P. betle* L. and its epiphytic leaf blades with colorful pattern from dark green, dark pink and white dapples. The plant has some similar characters to *P. ornatum* N. E. Br. (Brown 1884a) including being climber, epiphytic leaf adaxially thickly covered with small irregularly pinkish-white spots and dots, the old leaf duller and dark green, abaxially green, unspotted, but this new species can be easily identified by its monoecious, epiphytic leaf blades abaxially green, base cordate, petiole 2–5 cm long, densely white short hairy, free branching leaf blades ovate to broadly ovate, both sides green, base subrounded or subcordate with rounded and unequal lobes, basal lobes sometimes overlapping, bract peltate, stalk short and hairy, margin ciliated.

14. *Piper magnibaccum* C. DC., Rec. Bot. Surv. India 6: 5 (1912); Ridl., Fl. Malay Pen. 3: 46 (1967). (Fig. 15)

Monoecious, stout climber, much branching. Petiole 0.5–2 cm long; leaf blade leathery, glabrous, broadly elliptic-ovate, 5.5–8.5 cm wide, 14–17.5 cm long; apex acute or acuminate; base cuneate, rounded, or subcordate; veins elevating beneath, abaxially prominent, adaxially conspicuous, three pairs basal, others arising from midrib, reticulate veins many and transverse, not clearly seen. Male spike slender, 2–3 cm long; stamens 2.

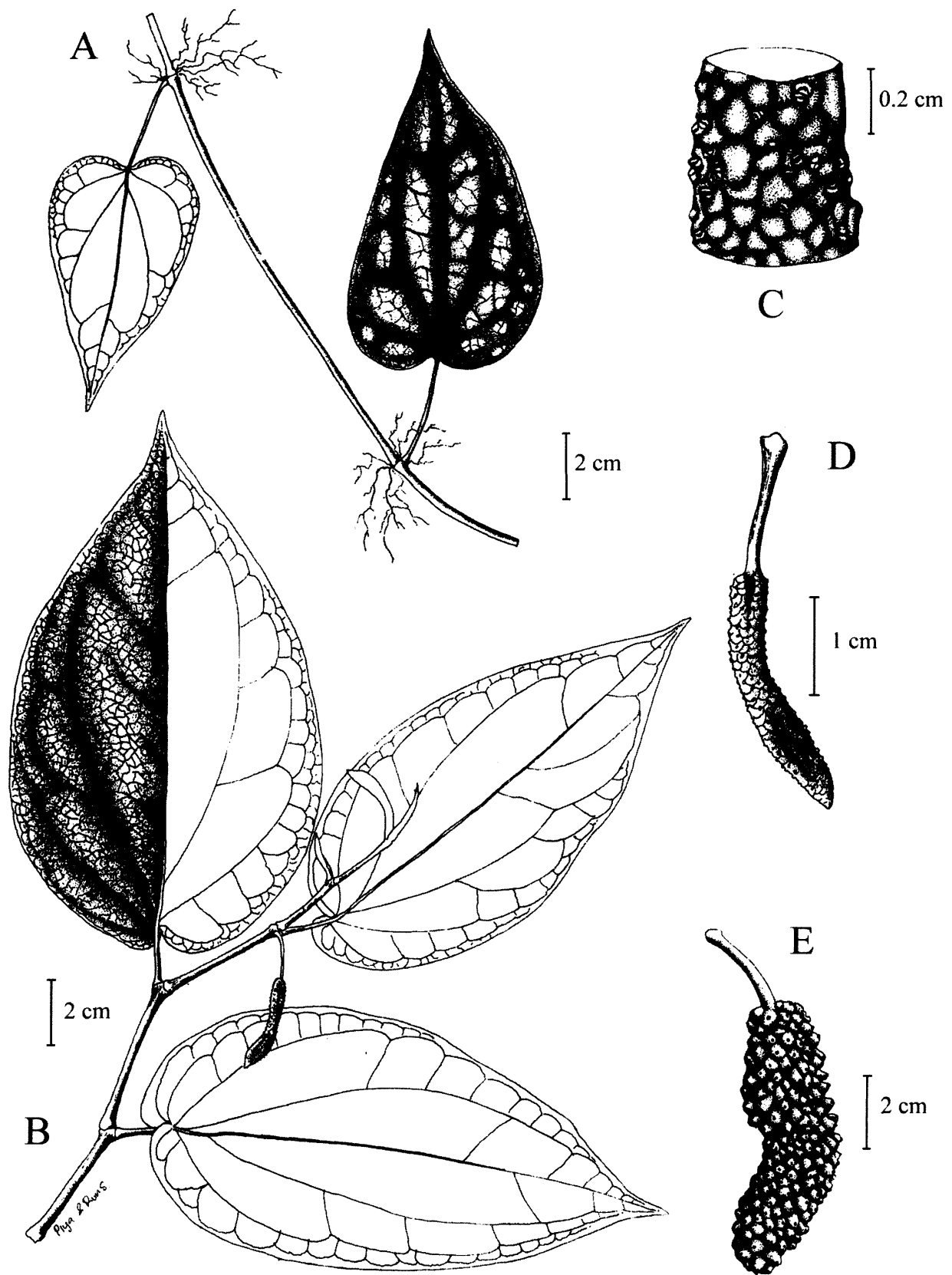


FIG. 13. *Piper maculaphyllum* Chaveer. & Sudmoon, sp. nov. A: Epiphytic branch. B: Free branch with spike. C: Part of flowering spike. D: Flowering spike. E: Fruiting spike. A. Chaveerach 126 (BK 63815).



FIG. 14. *Piper maculaphyllum* Chaveer. & Sudmoon, sp. nov. A: Epiphytic branches. B: Free branches. C: Flowering spike. D: Fruiting spike. A. Chaveerach 126 (BK 63815).

Fruiting spike 5–11 cm long; peduncle 1 cm long; drupe elliptic with conical point, sessile, arranged loosely on rachis. Flowering and fruiting on year round.

Local name. Sa-kan.

Distribution. Northern, Southern Thailand to Malaysia, 100–900 m alt.

Specimens examined. THAILAND: Northern, Chiang Mai province, 900 m alt., July 10, 1998, *A. Chaveerach* 5 (BK 63483), Chiang Rai province, 900 m alt., October 12, 1998, *A. Chaveerach* 13 (BK 63493); *B.M. Allen SING* 4703 (SING); *H. N. Ridley SING* 12056 (SING); *J. W. Anderson SING* 158 (SING).

15. *Piper montium* C. DC. in Lecomte, Fl. Indo-Chine 5: 80 (1910); Ho, Illust. Fl. Viet. 1: 298 (1999). (Fig. 16)

Dioecious, creeping on ground and then climbing on rocks, much branching, all parts glabrous. Leaves on epiphytic branches petiole 2–7 cm long; leaf blade ovate; apex acuminate; base cordate. Leaves on free branches petiole 1–2 cm long; leaf blade elliptic; apex long acuminate; base rounded or subtruncate. Leaf blade membranous, 5–9 cm wide, 11.5–17 cm long; veins 5–7, one or two pairs basal, other pairs arising 1–2 cm apart from base, alternate or opposite, reticulate veins prominent. Male spike pendulous, 13.8–25.5 cm long, 0.2–0.3 cm in diameter; peduncle 1.2–1.8 cm long; bract orbicular; stamens 3. Flowering from September to November.

Local name. Sa-kan.

Distribution. North-eastern Thailand to Vietnam, 800–900 m alt.

Specimen examined. THAILAND: North-eastern, Phu Luang Wildlife Sanctuary, Loei province, 900 m alt., July 10, 1998, *A. Chaveerach* 7 (BK 63485).

16. *Piper mullesua* Buch.-Ham. ex D. Don., Prodr. Fl. Nepal 20 (1825). (Fig. 17)

P. guigual Buch.-Ham. ex D. Don., Syst. Piperac. 306

(1843), teste Y. C. Tseng *et al.* (1999).

P. brachystachyum Wall. ex Hook. f., Fl. Brit. Ind. 5: 87 (1885), nom. illeg.

Monoecious, woody climber, all parts sparsely short pubescent. Stem slender, furrowed ridged when dried. Petiole grooved, 1–2 cm long; leaf blade papery and leathery, narrowly elliptic to elliptic or lanceolate, 2–5.5 cm wide, 11–13 cm long; apex caudate or long acuminate; base cuneate or suboblique; veins 7, abaxially raised and prominent, two pairs basal which one at the edge of leaf and not prominent, the other arising 1–3 cm apart from base, opposite or alternate, reticulate veins conspicuous. Spikes with male and female flowers together, straight up, 0.8–1.5 cm long, ca. 0.3 cm in diameter; peduncle 0.2–0.3 cm long; rachis pubescent; bract orbicular, peltate, with stalk shortly and pubescent; stamens 2; anther reniform; stigmas 3–4. Fruiting spike 1–2 cm long; drupe elliptic, 0.1–0.2 cm in diameter, with stalk shortly adjoined rachis. Flowering and fruiting from February to July.

Distribution. Northern Thailand to China, Bhutan, India, Nepal, 800–2100 m alt.

Specimens examined. THAILAND: Northern, Phu Hin Rong Kla National Park, Phitsanulok province, 900 m alt., December 30, 2003, *A. Chaveerach* 77 (BK); *C. F. van Beusekom et al. BKF* 4193 (BKF); *H. T. Tsai* 55468 (PE); *K. M. Feng* 8084 (PE 200005578); *R. Geesink et al. BKF* 6957 (BKF).

17. *Piper muricatum* Blume, Cat. Gew. Buitenz. 33 (1823); Rich. in Miq., Fl. Ned. Ind.: 454 (1859); Hook. f., Fl. Brit. Ind. 5: 82 (1885); Henderson in Malayan Wild Flowers: Dicotyledons 441 (1959); Baker *et al.* in Fl. Java 1: 169 (1963); Ridl., Fl. Malay Pen. 3: 32 (1967); Keng, Concise Fl. Singapore 62 (1990). (Fig. 18)

Dioecious, small shrub, 60–90 cm tall, all parts hairy. Petiole 0.5–0.7 cm long; leaf blade membranous, light to dark green, elliptic, lanceolate,

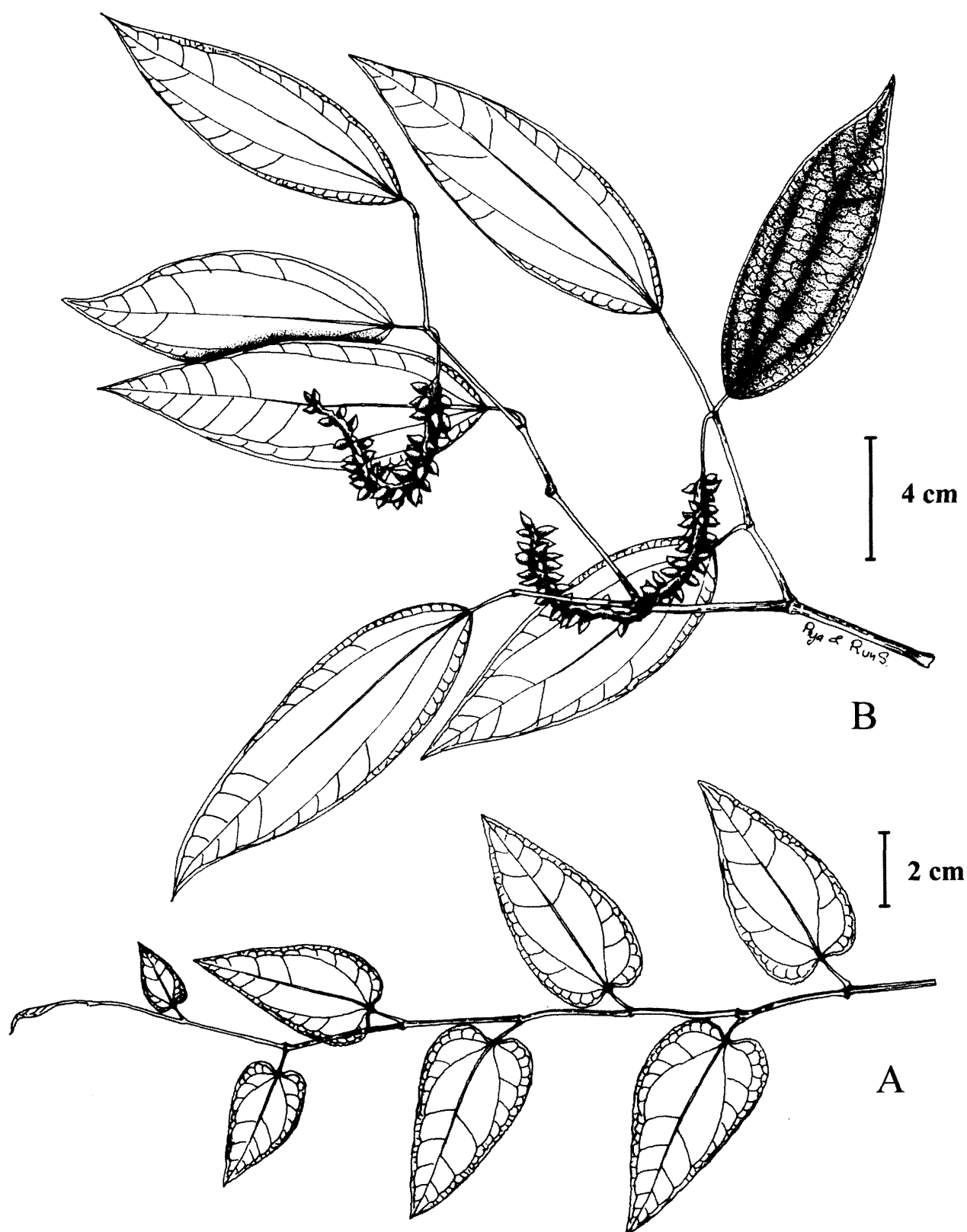


FIG. 15. *Piper magnibaccum* C. DC. A: Epiphytic branch. B: Free branch with fruiting spikes. A. Chaveerach 5 (BK 63483).

or ovate, 7–9 cm wide, 19–20 cm long; apex acuminate; base cuneate, rounded or oblique; veins 8, lower surface densely hairy, two pairs basal, the others arising 2–3 cm apart from base, alternate. Male spike 15–20 cm long, 0.3–0.5 cm in diameter; peduncle 1 cm long; bract rounded or elliptic; stamens 2. Flowering from September to January.

Local name. Sa-kan.

Distribution. Whole Thailand, to Indonesia, 100–1975 m alt.

Specimens examined. THAILAND: North-eastern, Phu Luang Wildlife Sanctuary, Loei province, 900 m alt., July 10, 1998, *A. Chaveerach* 6 (BK 63484); *H. N. Ridley SING* 15424 (SING); *J. F. Maxwell BKF* 046751, 090636 (BKF); *R. E. Holtum SING* 9678 (SING).

18. *Piper mutabile* C. DC. in Lecomte, Fl. Indo-Chine 5: 92 (1910); Y. C. Tseng *et al.* in Fl. China 4: 116 (1999); Ho, Illust. Fl. Viet. 1: 298 (1999). (Fig. 19)

Dioecious, slender climber, all parts glabrous. Petiole 1.5–4.5 cm long; leaf blade with yellow-reddish or brown-reddish glands, densely on abaxial and young leaf. Leaves on epiphytic branches blade thick, papery, ovate to broadly ovate, 7–9 cm wide, 11–14 cm long; apex acute; base cordate or subtruncate. Leaves on free branches blade narrowly ovate to ovate, 3–5 cm wide, 7–9 cm long; apex acuminate; base rounded, cuneate or suboblique. Veins 5–7, apical pair arising 0.5 cm apart from base, reaching leaf apex, others basal, reticulate veins abaxially prominent. Male spike 5.5 cm long, 0.2 cm in diameter; peduncle ca. 1 cm long; rachis long-white hairy; bract circular, overlap each other, margin free; stamens 2–3. Female spike 3–5 cm long, 0.2 cm in diameter; peduncle 1–2 cm long; rachis and bract as in male spike; stigmas 3. Fruiting spike 4–5 cm long; drupe ellipsoid globose, sparsely adnate to rachis, slightly pedicellate or slightly shrunken.

Male plants flowering on year round while female plants flowering and fruiting in rainy season, usually from July to November.

Distribution. Eastern Thailand to Vietnam, China, 400–900 m alt.

Specimens examined. THAILAND: Eastern, Khao Yai National Park, Nakhon Ratchasima province, 900 m alt., July 14, 2003, *A. Chaveerach* 52 (BK); *Ren-chang Qin* 8277 (PE 200005579).

19. *Piper nigrum* L., Sp. Pl. 1: 28 (1753). (Fig. 20)

Monoecious, stout climber, rooting at nodes. Petiole grooved, 0.8–1.5 cm long; leaf blade fleshy coriaceous, ovate to elliptic, 4–6 cm wide, 9–11 cm long; apex acuminate; base rounded to oblique; veins 7, two pairs basal, one pair arising 1–2 cm apart from base, reaching leaf apex. Spikes with male and female flowers together, 5–13 cm long, 0.3–0.5 cm in diameter; peduncle 1–1.5 cm long; stamens 2; stigmas 3. Fruiting spike 7–10 cm long; drupe globose, sessile, arranged loosely on rachis. Flowering and fruiting on year round.

Local name. Prik-thai.

Distribution. Through Thailand, Native to South-eastern Asia, 50–250 m alt.

Specimens examined. THAILAND: North-eastern, Khon Kaen province, 200 m alt., October 22, 1998, *A. Chaveerach* 17 (BK); 236-6 group 1081, Guang-hui Yang 57564 (PE 200005581); *A. F. G. Kerr BK* 18052 (BK); *D. J. Collins BK* 1010 (BK).

Notes. This species is cultivated through Thailand for spice used. It is an important commercial plant. Its fruit is used worldwide for spice and folk medicine.

20. *Piper pedicellatum* C. DC., J. Bot. 4: 164 (1866).

Dioecious, climber, much branching, glabrous,

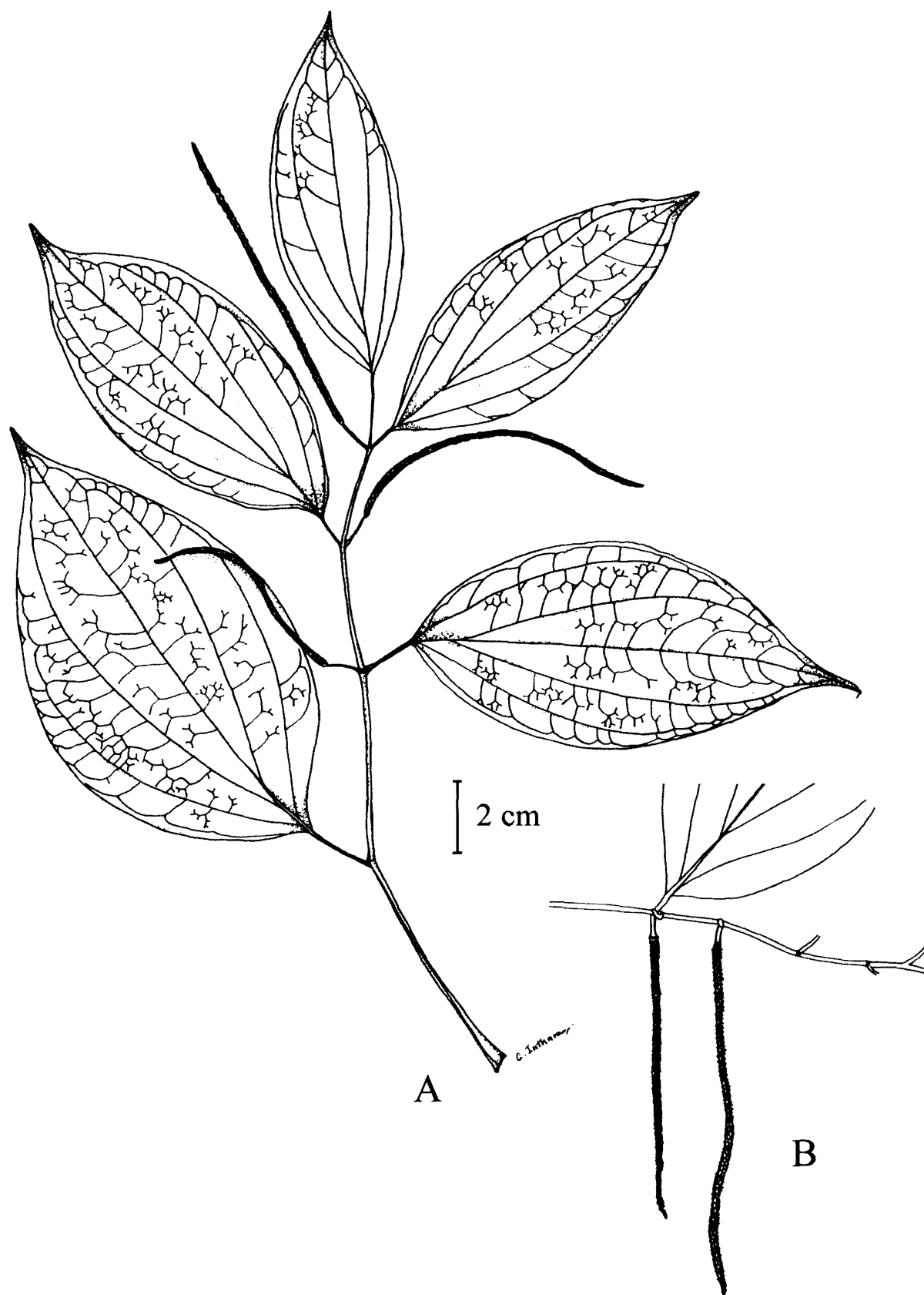


FIG. 16. *Piper montium* C. DC. A: Free branch with spikes. B: Male spikes. A. Chaveerach 7 (BK 63485).

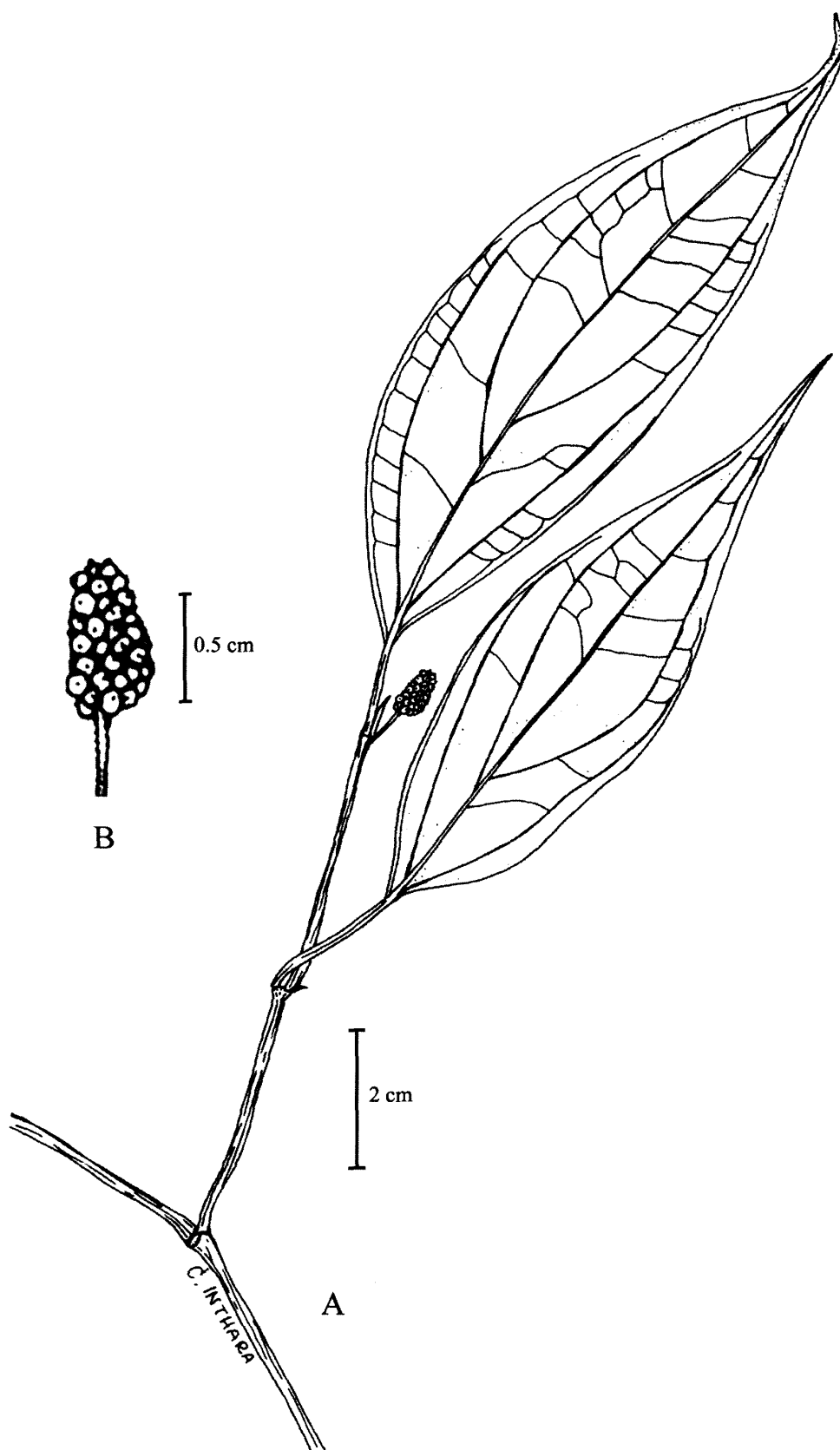


FIG. 17. *Piper mullesua* Buch.-Ham. ex D. Don. A: Free branch with fruiting spike. B: fruiting spike. A. Chaveerach 77 (BK).

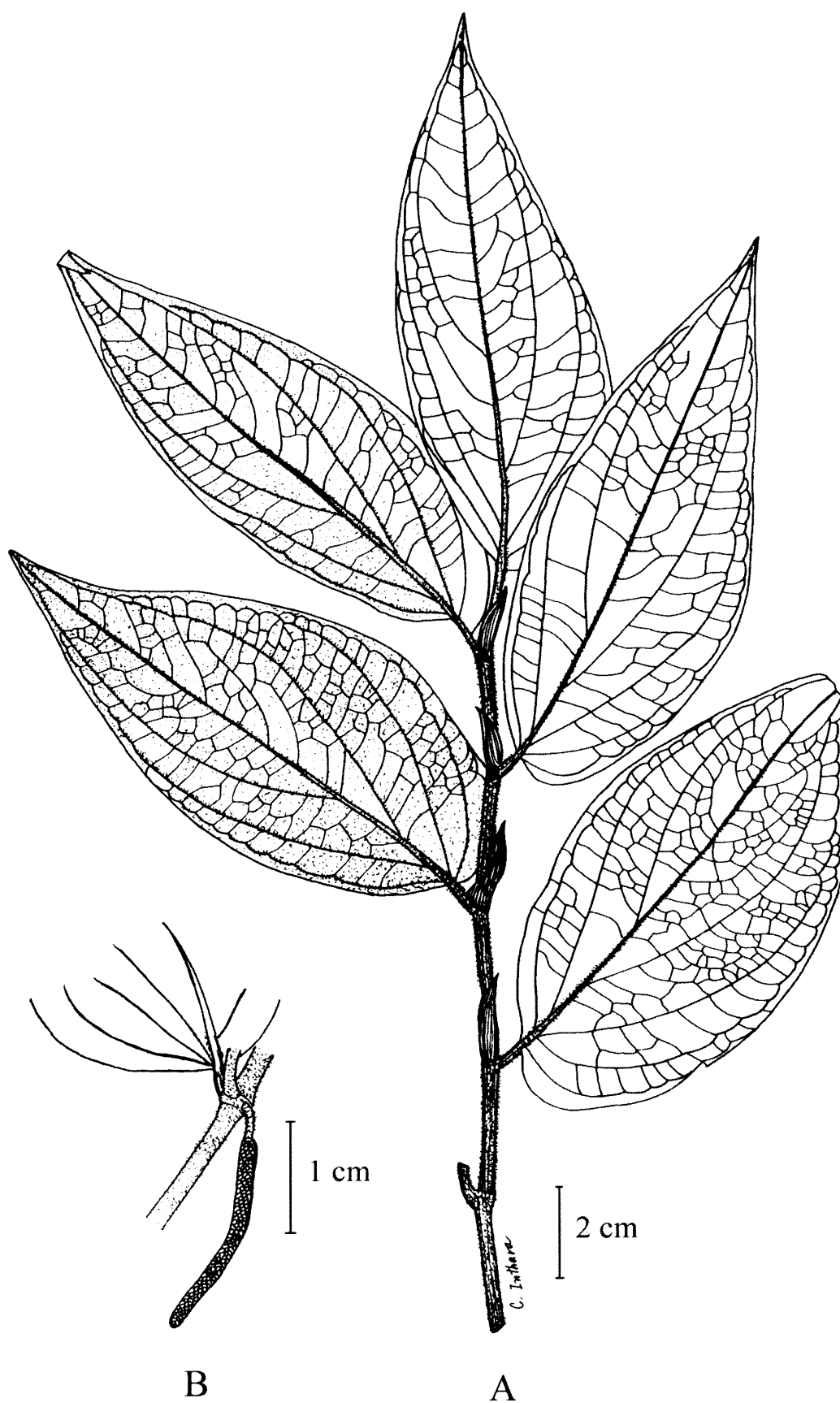


FIG. 18. *Piper muricatum* Blume. A: Branch. B: Young male spike. A. Chaveerach 6 (BK 63484).

pungent. Stem slender to stout, 0.2–0.5 cm in diameter. Petiole non-sheathed or non-sheathed at base, 0.8–1 cm long; leaf blade thick, undulated by veins, finely glandular or not glandular, dark green, food for insects, ovate, narrowly ovate to elliptic, 5–7 cm wide, 11–13 cm long; apex acuminate; base oblique with unequal lobes different long at base ca. 0.2 cm or unequal in both sides 0.5 cm distant; veins 7–9, abaxially prominent, 1–2 pairs basal, 1 pair arising from slightly above the base, distal pairs alternately arising from midrib at 2–4 cm apart from base, alternate, reticulate veins transverse conspicuous. Male spike not seen. Female spike pendulous, 9–13 cm long, 0.3–0.4 cm in diameter; peduncle 1.5–2 cm long; rachis pubescent; bract orbicular or peltate, with stalk base pubescent or glabrous and distinctively visible stalk 0.5–1 mm long; stigmas 3–4. Fruiting spike pendulous, 10–15 cm long; drupe obovoid, 4-angled or globose. Flowering and fruiting on year round.

1A. Petiole sheathed at base; leaf blade finely glandular; bract stalk pubescent at base; drupe 4-angled var. *pedicellatum*

1B. Petiole non-sheathed at base; leaf blade not glandular; bract stalk distinctively visible, glabrous; drupe globose var. *eglandulatum*

20A. var. *pedicellatum*

Petiole non-sheathed at base; leaf blade finely glandular, ovate, narrowly ovate to elliptic, base oblique with unequal lobes, different long at base ca. 0.2 cm. Bract orbicular with stalk pubescent at the base. Drupe 4-angled.

Distribution. Northern Thailand to Bangladesh, China, Bhutan, India, Sikkim, Vietnam, 1000–1700 m alt.

Specimens examined. THAILAND: Northern, Doi Inthanon National Park, Chiang Mai province, 1700 m alt., May 15, 2005, *A. Chaveerach* 218 (BK); *A. F. G. Kerr* BK 14336 (BK); *C. Phengklay* BKF 046745

(BKF); *J. F. Maxwell* BKF 046683 (BKF); *Qi-wu Wang* 80310 (PE 200005583).

20B. var. *eglandulatum* Chaveer. & Mookamul, *Acta Phytotax. Geobot.* 58(1): 35, fig. 2 (2007).

Petiole non-sheathed at base; leaf blade not glandular, elliptic to obovate; base unequal in both sides 0.5 cm distant. Bract peltate, with distinctively visible stalk 0.5–1 mm long, glabrous. Drupe globose.

Local name. Plu-doi-inthanon.

Distribution. Northern Thailand, Hill evergreen forest near water fall, 1700 m alt.

Specimen examined. THAILAND: Northern, Chiang Mai province, Doi Inthanon National Park, 1700 m alt., May 16, 2001, *A. Chaveerach* 48 (BK 63515, 63721).

21. *Piper pendulispicum* C. DC. in Lecomte, *Fl. Indo-Chine* 5: 78 (1910); Ho, *Illust. Fl. Viet.* 1: 299 (1999). (Fig. 21)

Dioecious, woody climber on rocks and trees, much branching. Stem stout, warted, node rooting, swollen and zigzag joint. Petiole 0.5–1 cm long; leaf blade thin leathery to coriaceous leathery, shiny light green to dark green, reddish when dried, ovate, ovate-lanceolate, elliptic, 7.8–14 cm wide, 14–20 cm long; apex acute to acuminate; base broadly-cuneate or oblique; veins 6–7, abaxially prominent, apical pair arising 1.5–2 cm apart from base, alternate, two pairs basal or the one out of two pairs arising near base. On the flowering branch, veins might be unequal in each side of midrib, 2 in one side and 3 in the other. Male spike pendulous, yellowish, 7–15 cm long, 0.3–0.5 cm in diameter; peduncle 1–2 cm long; rachis pubescent; bract orbicular, abaxially pubescent, arranged spirally on a spike; stamens 2, mature at different time, filament length unequal. Female spike pendulous, 10–20 cm long, ca. 0.5 cm in diameter; peduncle 1–2 cm long, rachis and bract

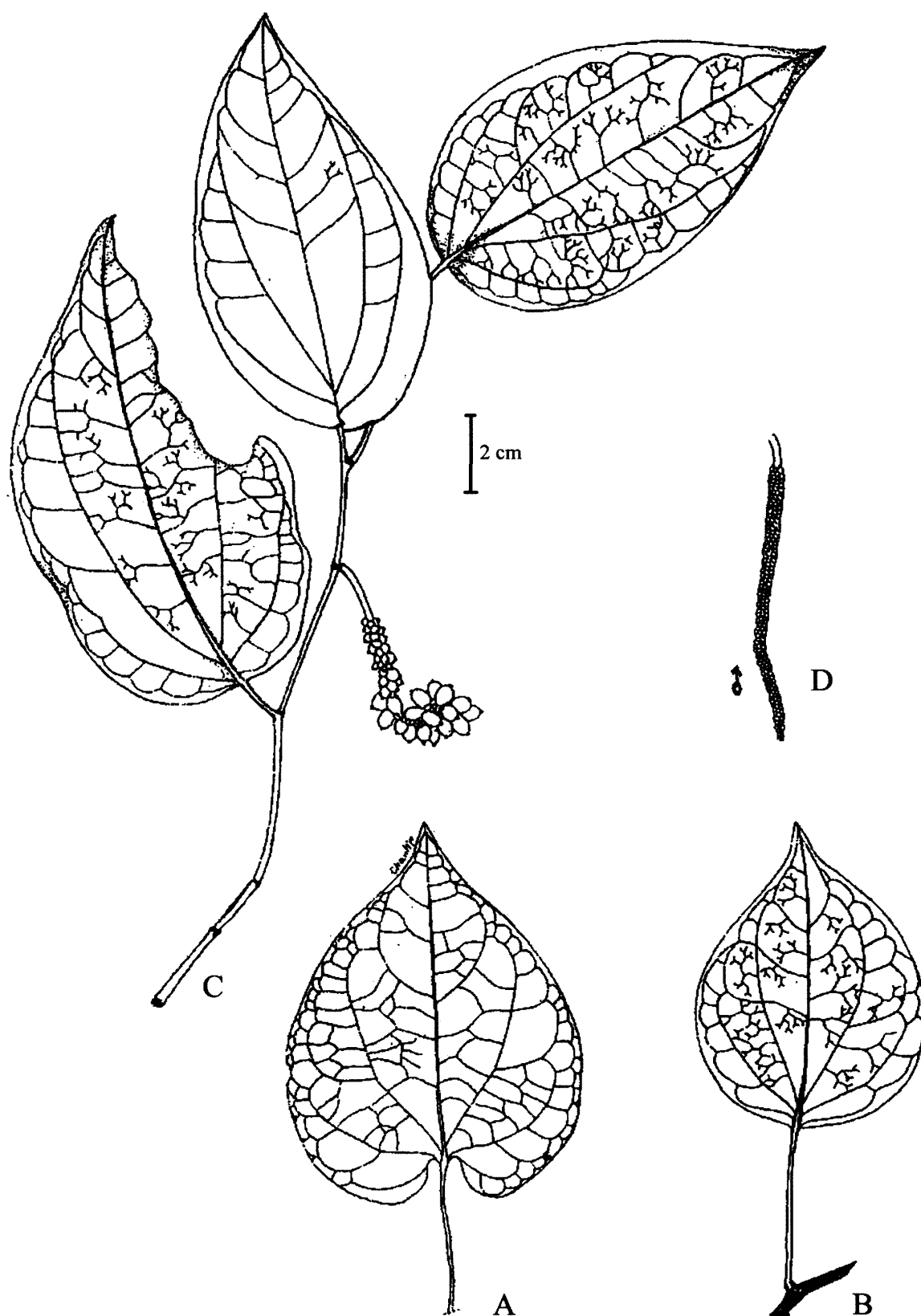


FIG. 19. *Piper mutabile* C. DC. A–B: Leaves on epiphytic branches. C: Free branch with fruiting spike. D: Male spike. A. Chaveerach 52 (BK).

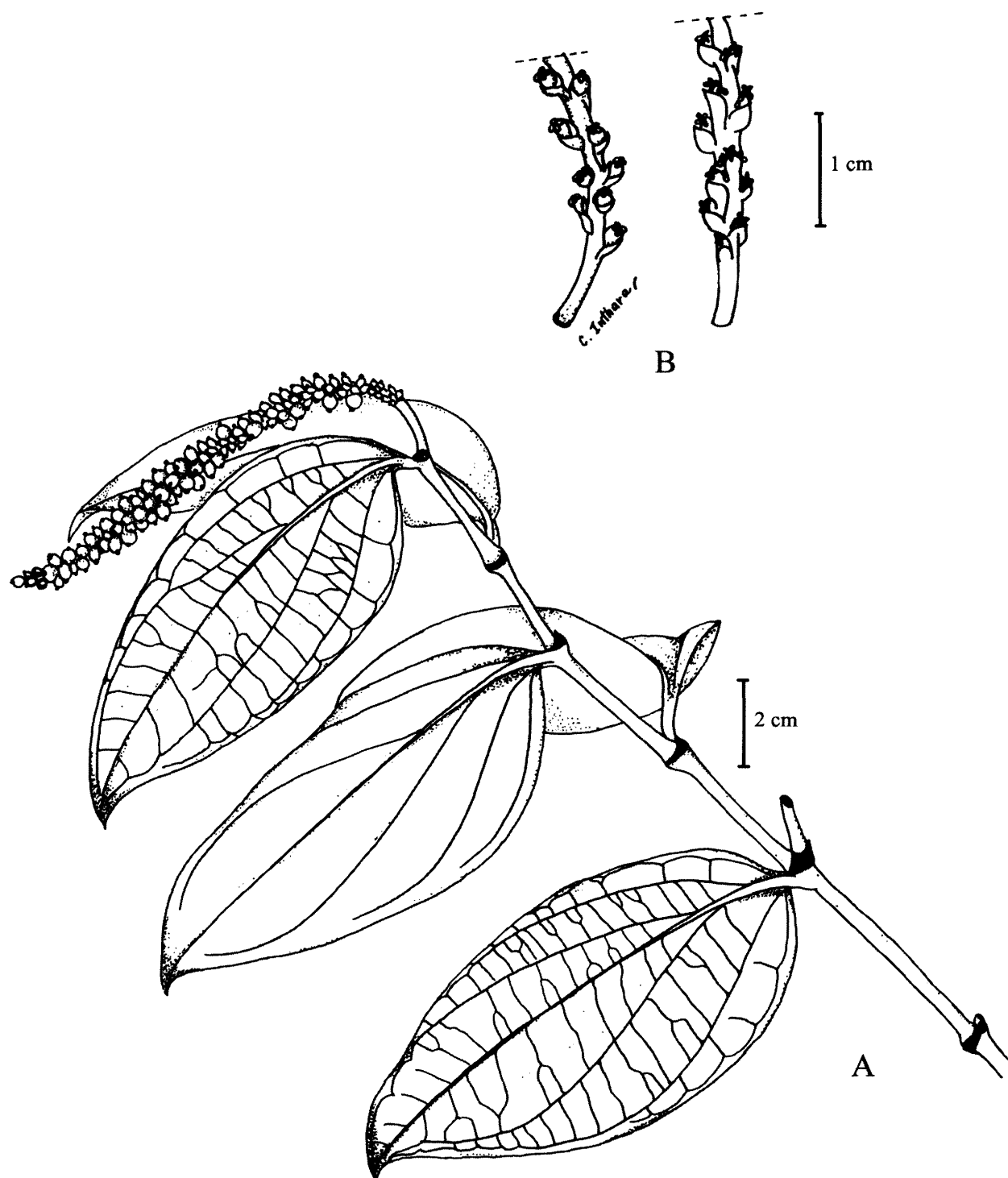


FIG. 20. *Piper nigrum* L. A: Free branch with fruiting spike. B: Parts of flowering spikes. A. Chaveerach 17 (BK).

as in male spike; stigmas 3–4. Fruiting spike up to 30 cm long; drupe sessile, ovoid or ellipsoid. Flowering and fruiting from November to March.

Local name. Sa-kan-nua, Ja-kan-jin, Sa-kan-dang.

Distribution. Northern, North-eastern Thailand to Vietnam, 200–1200 m alt.

Specimen examined. THAILAND: Northern, Doi Phu Kha National Park, Nan province, 1200 m alt., September 1, 2004, *A. Chaveerach* 82 (BK).

Notes. Female plant is called “Sa-kan-nua or Ja-kan-jin”. Its young stem is usually used for Northern local food. Male plant is called “Sa-kan-dang”. Its stem, a reddish wood, is usually used for folk medicine.

22. *Piper phuwaense* Chaveer. & Tanee, Acta Phytotax. Sin. 44(4): 449, fig. 2 (2006).

Dioecious, climbers on tree and rocks, glabrous, light green. Stem black, furrowed when dried. Leaves on epiphytic branches: petiole 1–2 cm long; leaf blade oblong, 2.7–3.2 cm wide, 7.5–8 cm long; apex acuminate; base cordate with equal basal lobes; veins 4 basal, one prominent pair reaching apex, others arising transversely from midrib joining the prominent pair. Leaves on free branches: petiole 0.5–1 cm long; leaf blade obovate, elliptic-oblong, 7–8 cm wide, 16–20 cm long; apex acuminate, cuspidate; base irregular auriculate, with lobes overlap each other; veins 7–8, distinctive, both sides prominent, 6–7 basal, apical pair arising 1.5–3 cm apart from base reaching apex, others arising transversely from midrib near apex joining the apical pair before reaching leaf margin. Male spike pendulous, 2–3 cm long, ca. 0.15 cm in diameter; peduncle 1 cm long; bract elliptic, rounded, not stalked, base overlap each other, margin ciliate; stamens 3. Female spike not seen. Flowering from October to November.

Local name. Plu-man.

Distribution. North-eastern Thailand.

Specimen examined. THAILAND: North-eastern, endemic to Phu Wua Wildlife Sanctuary, Nong Khai province, alt. 300–400 m alt., November 6, 2000, *A. Chaveerach* 46 (BK 63501, 63502, 63503).

Note. Its conservation status is a rare and endemic species to Phu Wua Wildlife Sanctuary area.

23. *Piper pilobracteatum* Chaveer. & Sudmoon, Acta Phytotax. Sin. 44(4): 449, fig. 3 (2006).

Dioecious, slender climber, glabrous. Stem node dilate, yellow when dried, 2–4 cm in diameter. Leaves in sunlight blade thick papery and undulate. Leaves in sunshade blade thinner. Petiole 1–1.2 cm long, sparsely hairy and persistent at base; leaf blade ovate, yellowish-green to green, yellowish to light brown when dried, sparsely hairy at base, yellowish or brownish glands, 4–6.5 cm wide, 8.5–13 cm long; apex acuminate; base rounded or subcuneate; veins 7, all basal or apical pair arising 0.5 cm apart from base reaching leaf apex, adaxially prominent, reticulate veins transverse. Male spike not seen. Female spike cylindrical, straight up, many blooming in sunlight, 1.5–1.9 cm long, ca. 0.3 cm in diameter; peduncle 0.8–1 cm long; bract circular, peltate, upper surface hairy, central densely hairy, margin ciliate, rachis densely hairy, with stalk base hairy; stigmas 4 often 5 on a spike. Fruiting spike 1.5–2 cm long; drupe rounded in sunlight or with conical point in sunshade, ca. 0.5 cm in diameter, green, greenish-brown and red when ripe, arranged loosely on rachis, pedicel ca. 0.2 cm long. Flowering and fruiting from September to November.

Local Name. Plu-sri-phang-nga.

Distribution. Southern Thailand.

Specimen examined. THAILAND: Southern, Sri Phang Nga National Park, Phang Nga province, alt. 100 m alt., October 19, 2000, *A. Chaveerach* 41 (BK 63495, 63496).

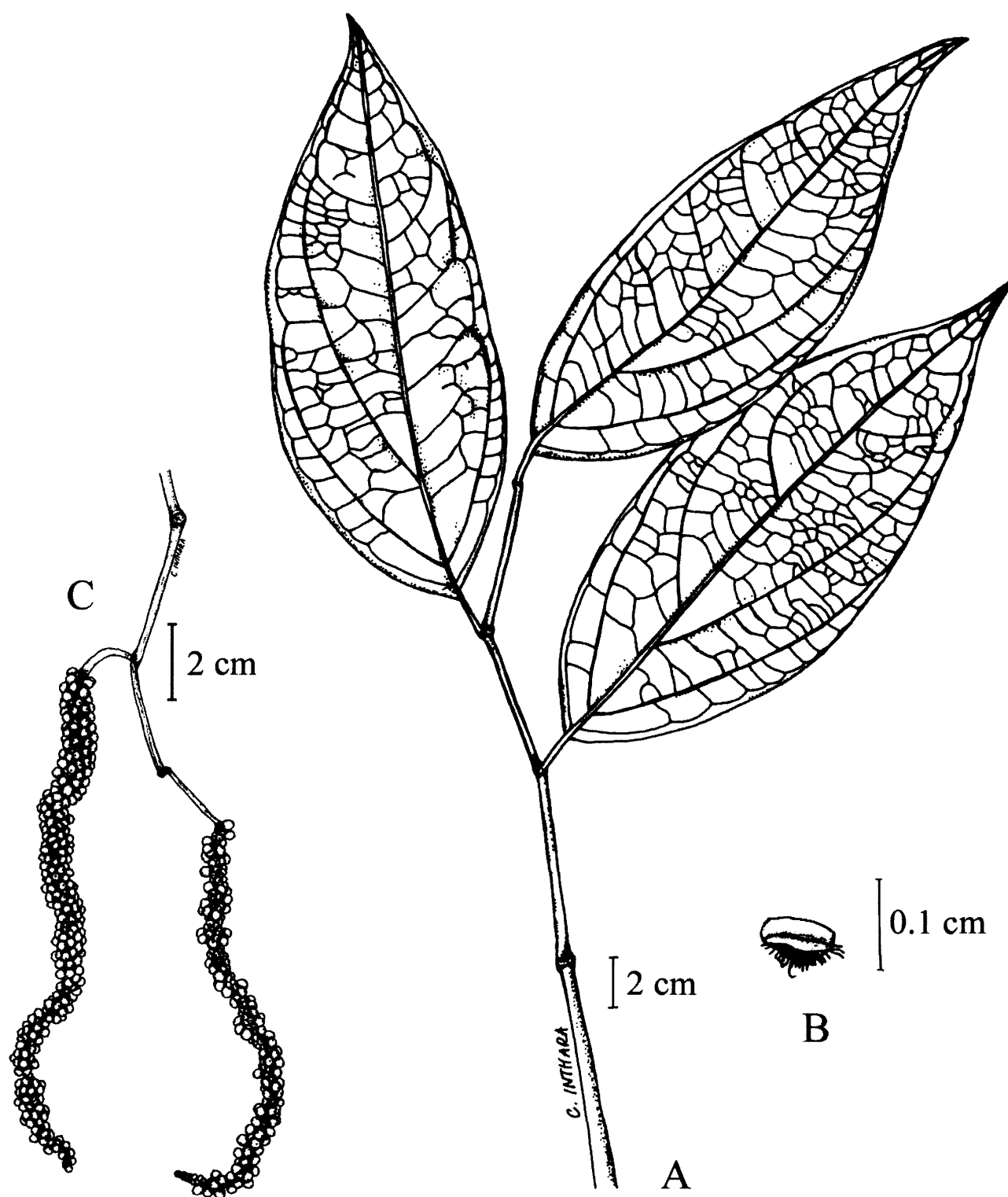


FIG. 21. *Piper pendulispicum* C. DC. A: Free branch. B: Bract. C: Fruiting spikes. A. Chaveerach 82 (BK).

24. *Piper politifolium* C. DC. in Lecomte, Fl. Indo-Chine 5: 81 (1910); Ho, Illust. Fl. Viet. 1: 299 (1999). (Fig. 22)

Dioecious, slender climber, glabrous. There are clarified variations of morphological characters, therefore, male and female plants are separately described. Male plants: Petiole 0.1–1 cm long; leaf blade elliptic, 2.7–4 cm wide, 8–16 cm long, usually bigger than leaf blade of female plants; apex acute or acuminate; base oblique; veins pinnerves, 2 or 3 basal, others arising from midrib. Spikes pendulous, 6–8 cm long, 0.2–0.3 cm in diameter; peduncle ca. 1.5 cm long; bract oblong, margin ciliate; stamens 2. Female plants: Petiole 0.7–1.5 cm long; leaf blade elliptic, 3.5–8 cm wide, 8.5–20 cm long, the lower ones occasionally smaller than the top ones; apex, base and vein characters as in male plants. Spikes pendulous, 11–12 cm long, ca. 0.3 cm in diameter; peduncle 3–5 cm long; bract oblong, margin with longer ciliate than in male plants; stigmas 4. Fruiting spike 11–13 cm long; drupe globose, 0.5 cm in diameter, pedicel ca. 0.4 cm long. Flowering and fruiting from October to January.

Distribution. Northern Thailand to Vietnam, 800–900 m alt.

Specimen examined. THAILAND: Northern, Doi Phu Kha National Park, Nan province, 900 m alt., December 20, 2003, A. Chaveerach 55 (BK).

25. *Piper polysyphonum* C. DC., Bull. Herb. Boissier, ser. 2, 4: 1026 (1904). (Fig. 23)

P. mekongense C. DC. in Lecomte, Fl. Indo-Chine 5: 90 (1910), teste Chang et al. (1999).

Monoecious with male and female flowers together on a spike, male plants are also seen, slender climbers. Stem slender, glabrous, with scattered pellucid glands. Petiole 1–1.5 cm long; leaf blade papery, with scattered pellucid glands, dark green, ovate to elliptic, 4.2–7.5 cm wide, 13–16.5 cm

long; apex short acuminate; base rounded, sub-cuneate or oblique; veins 7–9, abaxially often reddish when dried, apical pair arising 1.6–2 cm apart from base, alternate, reaching leaf apex, others basal or arising near base, reticulate veins transverse. Spikes pendulous, 16–23 cm long, ca. 0.2 cm in diameter, flowers sparsely scattered on rachis; peduncle 3–3.5 cm long; bract ovate to oblong, base adnate to rachis, margin and apex free; stamens 3, with long filament, exerted from bract. Fruiting spike 16–25 cm long; drupe ovoid, ca. 0.3 cm in diameter, sessile. Flowering and fruiting from September to November.

There are some different characters between the investigated plant and the plant described in Fl. China 4: 116 (1999). The dominant distinctive characters are subshrub and dioecious only, but the dominant anther character indicates the species-specific character of *P. polysyphonum*.

Distribution. South-western Thailand to China, Laos, 800–1400 m alt.

Specimen examined. THAILAND: South-western, nearby streams and waterfalls within forests, Huay Yang National Park, Prachob Kirikhan province, 100 m alt., October 17, 2004, A. Chaveerach 94 (BK).

26. *Piper retrofractum* Vahl, Enum. Pl. 1: 314 (1804); Y. C. Tseng *et al.* in Fl. China 4: 128 (1999). (Fig. 24)

P. officinarum C. DC. in A. DC., Prodr. 16(1): 356 (1869).

P. chaba Hunt., As. Res. 9: 391 (1809); Hook. f., Fl. Brit. Ind. 5: 83 (1885); Ridl., Fl. Malay Pen. 3: 40 (1967); Keng, Concise Fl. Singapore 62 (1990).

Monoecious, climber. Stem stout, node dilated and rooting. Petiole 0.8–1.2 cm long; leaf blade coriaceous, glabrous, entire, oblong, ovate, or lanceolate, 4–6 cm wide, 10–17 cm long; apex acuminate; base cordate, rounded, or oblique; veins one or two pairs basal, the others arising alternately from midrib. Spike straight up, 3–5.5 cm

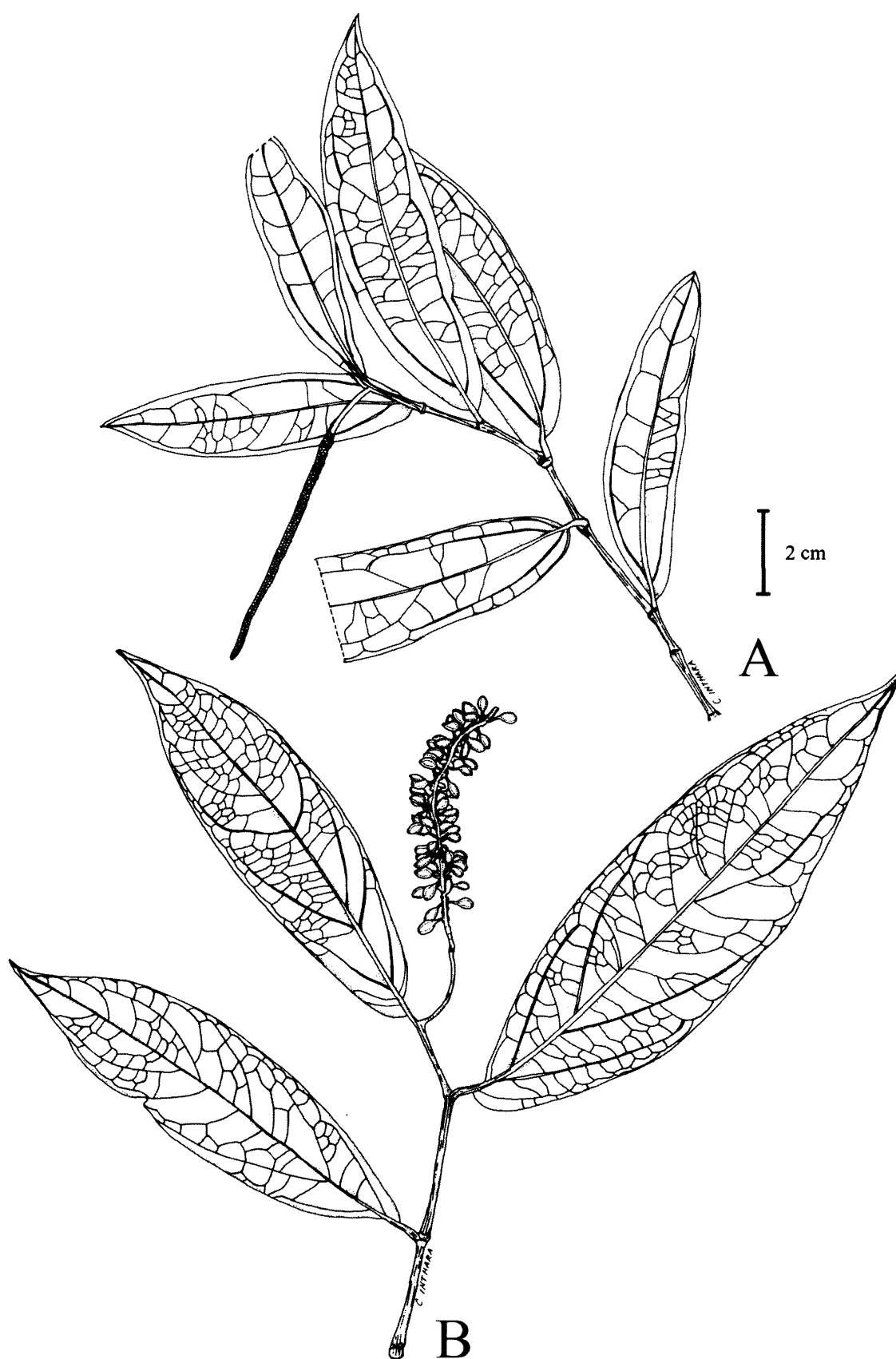


FIG. 22. *Piper politifolium* C. DC. A: Free branch with male spike. B: Free branch with fruiting spike. A. Chaveerach 55 (BK).

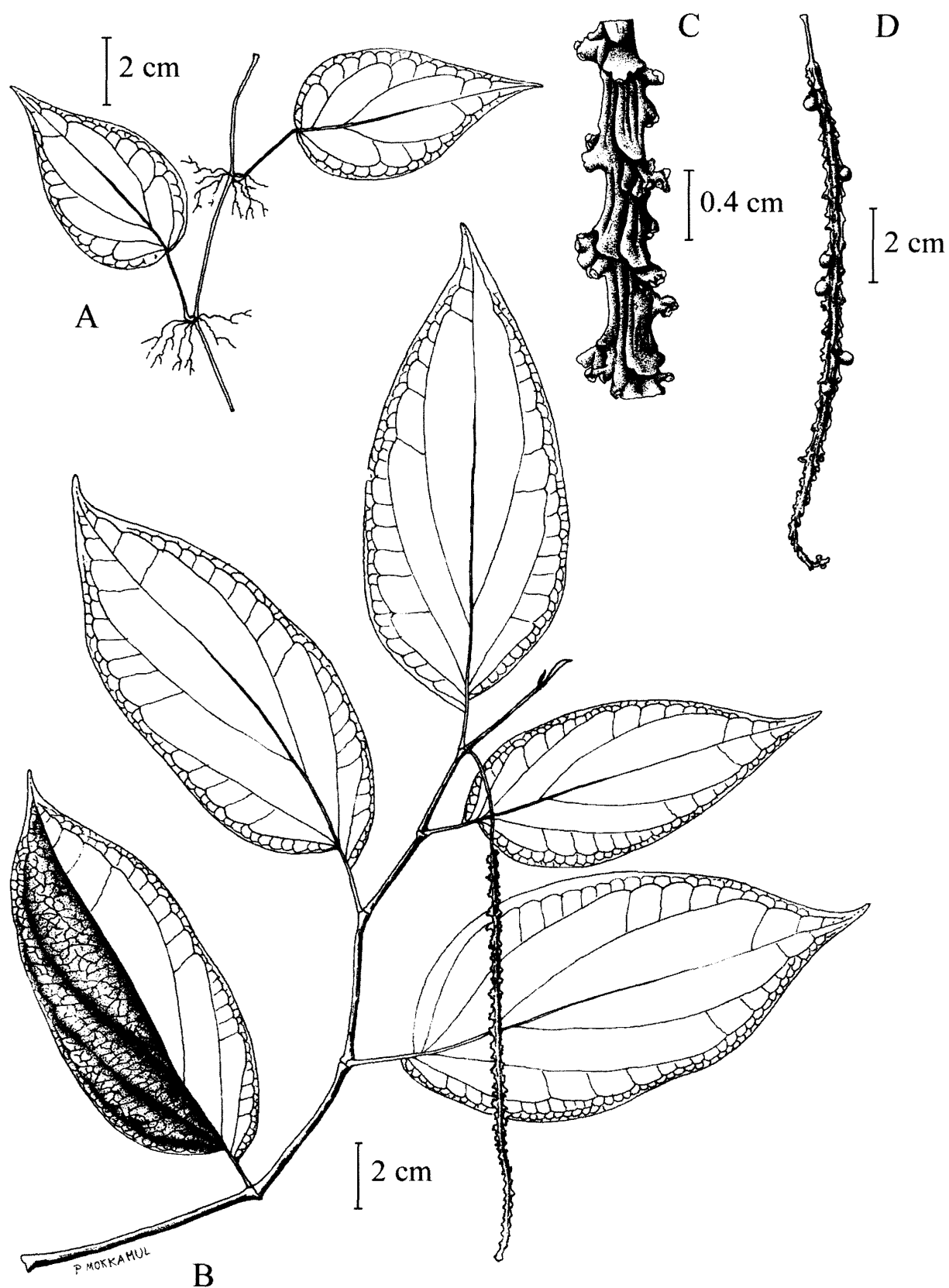


FIG. 23. *Piper polysyphonum* C. DC. A: Epiphytic branch. B: Free branch with spike. C: part of spike. D: fruiting spike. A. Chaveerach 94 (BK).



FIG. 24. *Piper retrofractum* Vahl. A: Free branch with flowering and fruiting spikes. A. Chaveerach 9 (BK 63488).

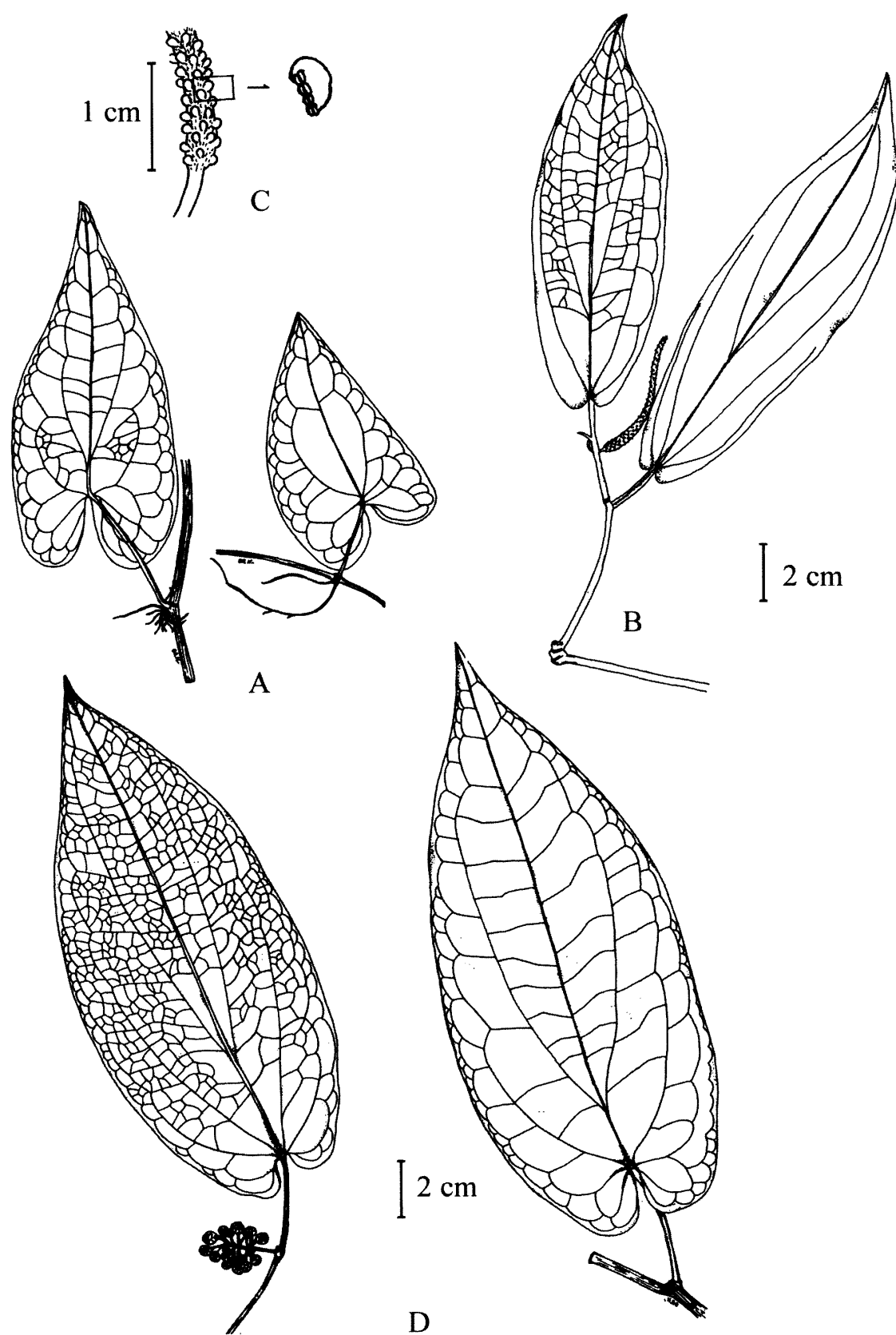


FIG. 25. *Piper ribesioides* Wall. A: Leaves on epiphytic branches. B: Free branch with spike. C: Part of spike with enlarged flower. D: Leaves on free branches with fruiting spike. A. Chaveerach 1 (BK 63478).

long, 0.5–0.7 cm in diameter; peduncle 1–1.2 cm long; bract orbicular; stamens 2; stigmas 3. Fruiting spike stout, conico-cylindric, 3.5–6 cm long; drupe globose, embedded on rachis, red when ripen. Flowering on year round.

Local name. Dipli, Dipli-chueak.

Distribution. Whole Thailand to India, Malaysia, 50–700 m alt.

Specimens examined. THAILAND: North-eastern, Khon Kaen province, 200 m alt., October 2, 1998, *A. Chaveerach* 9 (BK 63488); *A. F. G. Kerr* BK 8966 (BK); *H. N. Ridley* SING 14966A (SING); *M. Furuse* 3307 (PE 200005592).

Note. This species is cultivated throughout the country for its fruit, used in traditional medicine and spice, now a day it is often seen as an ornamental plant because of its beautiful bush shape and ripe fruit.

27. *Piper ribesioides* Wall., Pl. As. Rar. 1: 79, t 9 (1830); Hook. f., Fl. Brit. Ind. 5: 81 (1885); Henderson in Malayan Wild Flowers: Dicotyledons 442 (1959); Ridl., Fl. Malay Pen. 3: 34 (1967); Keng, Concise Fl. Singapore 63 (1990). (Fig. 25)

Monoecious, stout climber, all parts glabrous. Stem rather stout, Petiole 3–7 cm long; leaf blade thick leathery, vary in shape and size. Leaves on epiphytic branches blade deltoid and tapering to apex or narrowly ovate; apex acute; base deeply cordate with equal or unequal lobes, 5–11.5 cm wide, 8–22 cm long. Leaves on free branches blade elliptic; apex acute or acuminate; base cordate, size as above. Veins 9, three pairs basal, others arising 2–3 cm apart from base, opposite or alternate. Male spike pendulous, 5–8 cm long, 0.1–0.2 cm in diameter; peduncle 0.5–0.8 cm long; bract peltate; stamens 4. Fruiting spike 2–18 cm long; drupe globose, 0.3–0.6 cm in diameter, arranged loosely, red when ripe; pedicel 0.5–0.6 cm long. Flowering and fruiting on year round.

Local name. Ta-kan-lek.

Distribution. Eastern and Southern Thailand to Myanmar, India, Singapore, 0–900 m alt.

Specimens examined. THAILAND: Eastern, Khao Yai National Park, Nakhon Ratchasima province, 900 m alt., July 9, 1998, *A. Chaveerach* 1 (BK 63478), Peninsula, Nam Tok Ngao National Park, Ranong province, 100 m alt., October 26, 2004, *A. Chaveerach* 189 (BK 63479; BKF 046887, 046889); *A. F. G. Kerr* BK 7330, 8966, 9455, 12140 (BK); *J. F. Maxwell* BK 74-748, 75-4, 76-116 (BK), BKF 86-213 (BKF).

28. *Piper rubroglandulosum* Chaveer. & Mokkamul, *sp. nov.* (Figs. 26, 27)

Haec species *P. prophyphylo* N. E. Br. similis, sed differt laminis anguste ovatis, late ovatis vel ellipticis, 4–5 cm latis, 7.5–11 cm longis, petiolo 0.5–1.5 cm longis, 7-nerviis, 4 nervis basalibus, duabus distalibus oppositis vel alternis e costa 0.5–1.5 cm a basi distante exorientibus et ad apicem attingentibus, spicis masculinis pendulis, 5.5–10 cm longis, bracteis subrotundatis rachidis brevibus pubescentibusque, staminibus 2.

Typus. THAILAND: Southern, Surat Thani province, Khlong Phanom National Park, 100–200 m alt., October 21, 2004, *A. Chaveerach* 314 (holo- BK [BK63816]; iso- BKF).

Slender climber to stout climbers, much fragrance likes *P. betle*. There are some different characters of investigated plants depending on the areas found. The first type, plants commonly seen, is described as followed. Leaves on epiphytic branches petiole pinkish-green; leaf blade narrowly ovate, adaxially dark green, abaxially light pink; abaxially veins dark pink. The second type, plants found at Khao Phra Thaeo Wildlife Conservation Development and Extension Center and Khlong Phanom National Park, is described as followed. Plants are smaller than the first type in the same locality. Leaves on epiphytic branches petiole pinkish-green stripes or absent; leaf blade broadly ovate, adaxially green or pinkish-light green; abaxially veins green. The common characters are described as followed. Stem slender to stout, stiff, often pinkish-green stripes, yellowish-

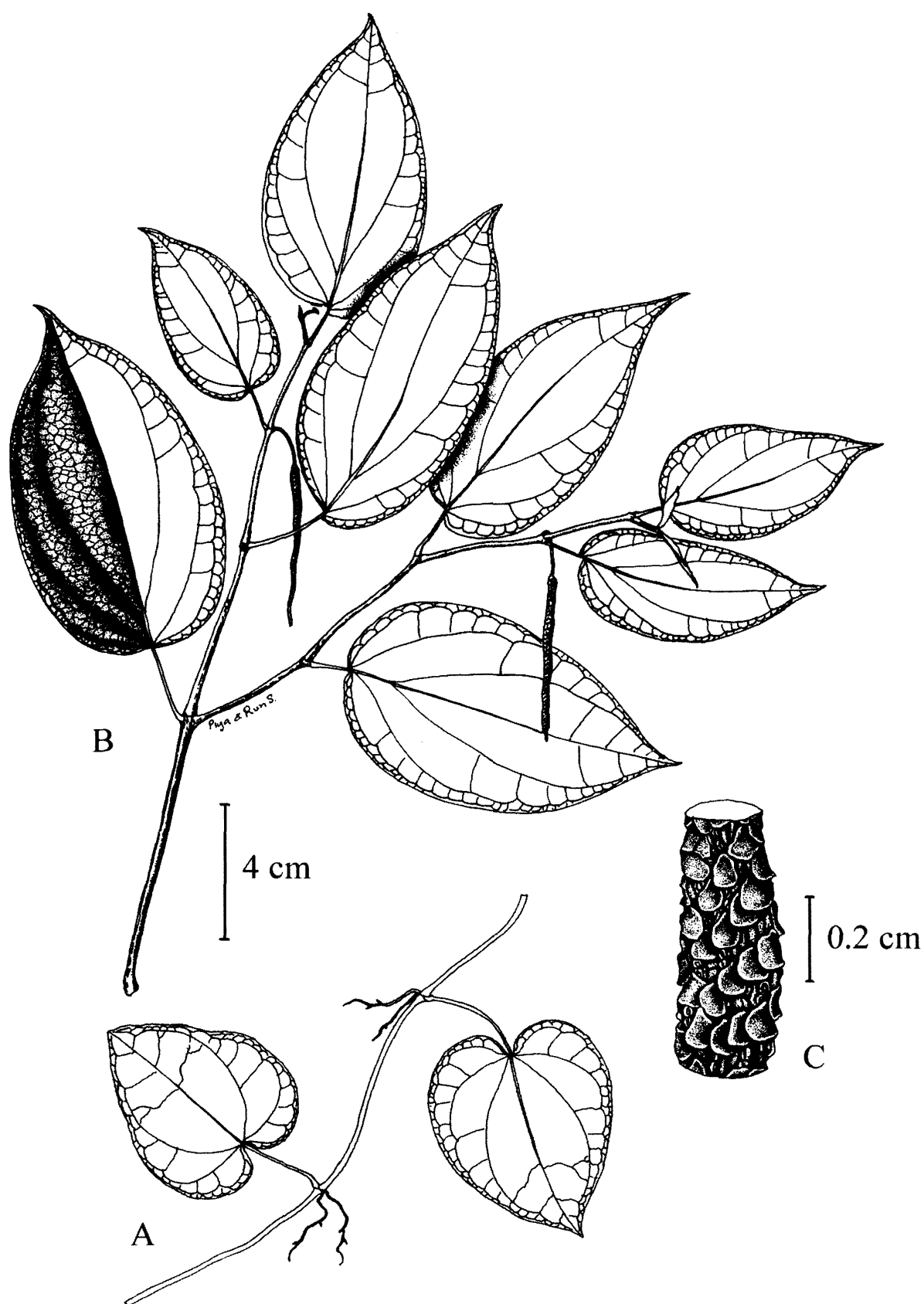


FIG. 26. *Piper rubroglandulosum* Chaveer. & Mookamul, sp. nov. A: Epiphytic branch. B: Free branch with spikes. C: Part of spike. A. Chaveerach 314 (BK 63816).

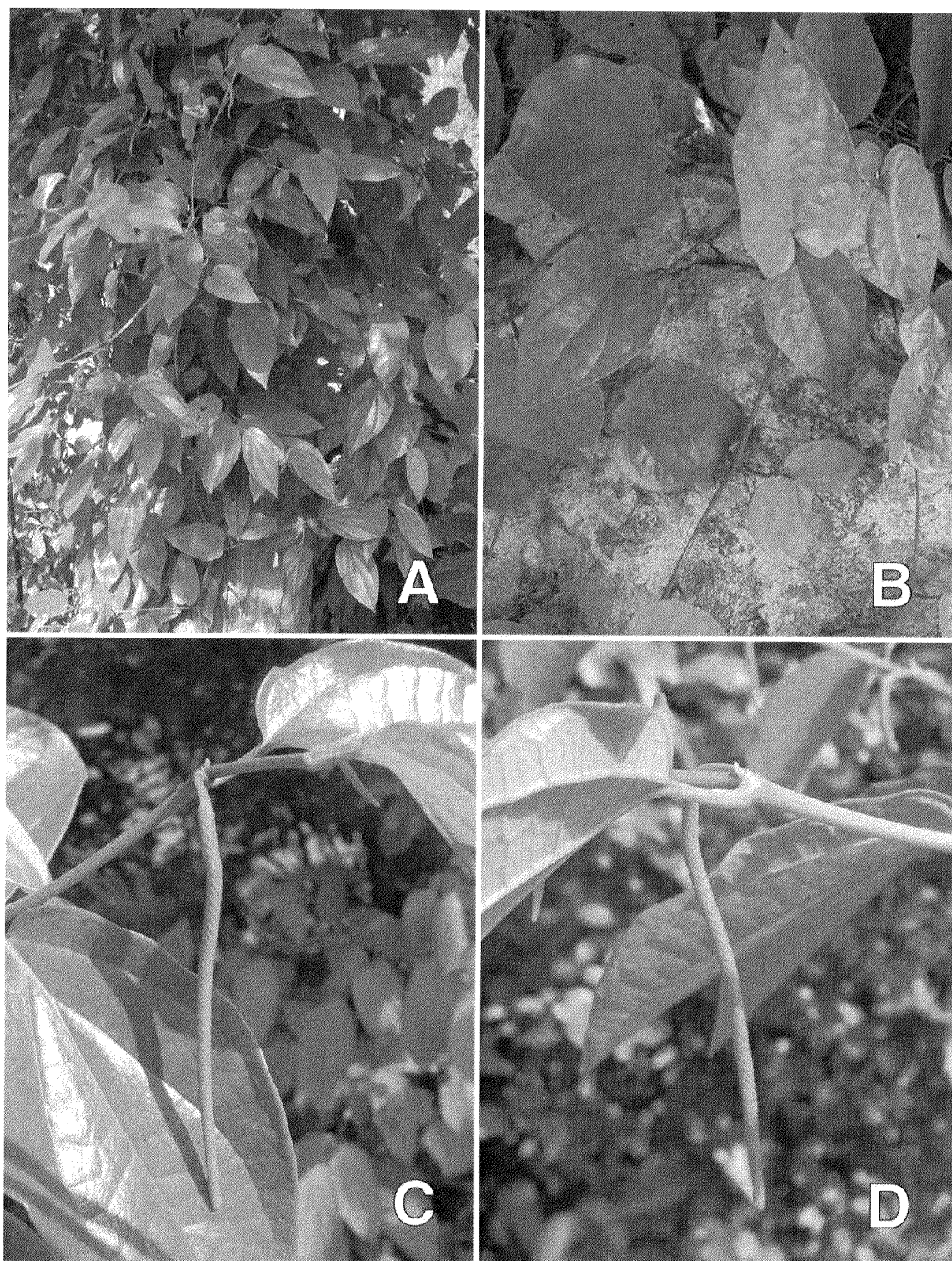


FIG. 27. *Piper rubroglandulosum* Chaveer. & Mokkamul, sp. nov. A: Free branches. B: Epiphytic branches. C: Male spike. D: Free branch showing petiole, leaves abaxially and a male spike. A. Chaveerach 314 (BK 63816).

blackish and furrowed when dried. Petiole sparsely pubescent, 0.5–1.5 cm long; leaves on epiphytic branches blade adaxially green to dark green, yellowish when dried, with densely reddish glands, ovate or elliptic, 4–5 cm wide, 7.5–11 cm long; apex acute or cuspidate; base shallowly cordate often oblique; veins 7, adaxially prominent, apical pair arising 0.5–1.5 cm apart from base, opposite or alternate reaching leaf apex, reticulate veins conspicuous. Male spike pendulous, 5.5–10 cm long, ca. 0.2 cm in diameter; peduncle 1.2–2 cm long; rachis hairy; bract subrounded, margin free, stalk short and pubescent; stamens 2. Flowering from September to November.

Local name. Sa-kan, Plu-ki-kai, Plu-thuan.

Distribution. Thailand, Moist evergreen forest, near waterfall and stream, climbing up on the cliff, 100–900 m alt.

Other Specimen examined. THAILAND: Southern, Phuket province, Khao Phra Thaeo Wildlife Conservation Development and Extension Center, 100–900 m alt., October 23, 2004, *A. Chaveerach* 316 (BK); Southern, Phang Nga province, Sri Phang Nga National Park, 100–900 m alt., October 23, 2004, *A. Chaveerach* 317 (BK); Northeastern, Loei province, Phu Luang Wildlife Sanctuary, 800–900 m alt., December 25, 2004, *A. Chaveerach* 318 (BK); Central, Suphan Buri province, Phu Toei National Park, 800–900 m alt., December 26, 2004, *A. Chaveerach* 319 (BK).

Notes. This new species is named by its free branching leaf blades abaxially with distributed red glands that especially different character from the other botanically reported species. The plant has some similar characters to *P. porphyrophyllum* N. E. Br. (Brown 1884b, Ridley 1967) including being climber, free branching leaf adaxially green to dark green with densely reddish glands, abaxially light pink apex acute or cuspidate, but this new species can be easily identified by its leaf blades narrowly ovate, broadly ovate or elliptic, 4–5 cm wide, 7.5–11 cm long, base cordate, veins 7, four basal and an apical pair arising 0.5–1.5 cm

apart from base opposite or alternate reaching leaf apex, male spike ca. 0.2 cm in diameter, 5.5–10 cm long, stamens 2.

29. *Piper sarmentosum* Roxb., Fl. Ind. 1: 162 (1820). (Fig. 28)

P. brevicaule C. DC., Annaire Conserv. Jard. Bot. Genève 272 (1898), non Poir. (1816).

P. albispicum C. DC. in Lecomte, Fl. Indo-Chine 5: 85 (1910), teste Y. C. Tseng *et al.* (1999).

P. gymnostachyum C. DC. in Lecomte, Fl. Indo-Chine 5: 72 (1910), teste Y. C. Tseng *et al.* (1999).

P. pierrei C. DC. in Lecomte, Fl. Indo-Chine 5: 78 (1910), teste Y. C. Tseng *et al.* (1999).

P. saigonense C. DC. in Lecomte, Fl. Indo-Chine 5: 79 (1910), teste Y. C. Tseng *et al.* (1999).

Monoecious, normally small shrubs, 30 cm tall, sometimes climber, all parts glabrous. Petiole 1–2.5 cm long; leaf blade thin to thick chartaceous or papery, light to dark green, broadly ovate to elliptic, 4.5–6 cm wide, 7.5–9.5 cm long; apex acute; leaves on epiphytic branches base deeply equally cordate with rounded lobes, leaves on free branch base cuneate to subtruncate; veins 7, all basal. Spike with male and female flowers together straight up, cylindrical, 1–1.5 cm long, 0.3–0.5 cm in diameter; peduncle ca. 1.5 cm long; bract rounded; stamen 1; stigmas 3–4. Female spike white cylindric, other characters are as above. Fruiting spike 1–2 cm long, 0.5–1 cm in diameter. Flowering on year round, many in rainy season.

Local name. Cha-plu

Distribution. Whole Thailand to India, China, Cambodia, Indonesia, Laos, Malaysia, Philippines, Vietnam, 1000 m alt.

Specimens examined. THAILAND: North-eastern, Khon Kaen province, 200 m alt., this plant has been cultivated throughout the country for cooking, medicine and vegetable, October 22, 1998, *A. Chaveerach* 18 (BK); *A. F. G. Kerr* BK 11041 (BK); *Miao-xian Huang* 110920 (PE 200005594); *H. N. Ridley* SING 4223 (SING); *J. F. Maxwell* BK 72-392, 74-960 (BK).

Note. This species is cultivated for cooking, medicine and vegetable, the climber type has seen at the Peninsula.

30. *Piper semiimmersum* C. DC., Notizbl. Bot. Gart. Berlin-Dahlem 6: 479 (1917). (Fig. 29)

Dioecious, climber, fragrance much alike *P. betle*. Stem sparsely hispid. Petiole densely long-pubescent, 0.5–1 cm long; leaf blade papery, much of bullate when mature, adaxially glabrous or sparsely pubescent near base, abaxially hispidulous along veins, light green, ovate-lanceolate or ovate-oblong, 2.5–8 cm wide, 11–17 cm long; apex short acuminate; base oblique, rounded or subcordate with divergent or overlap lobes; veins 7, apical pair arising 0.5–2 cm apart from base, usually alternate, reaching leaf apex, others basal, reticulate veins conspicuous. Male spike 6–8 cm long; ca. 0.2 cm in diameter; peduncle 2–2.5 cm long, sparsely pubescent or nearly glabrous; bract suborbicular-orbicular peltate; stamens 2, anther reniform, filament short or absent. Flowering from April to June.

Distribution. Southern Thailand to China, Vietnam, 100–600 m alt.

Specimens examined. THAILAND: Peninsula, Sri Phang Nga National Park, Phang Nga province, 100 m alt., October 19, 2004, *A. Chaveerach* 115 (BK); *China & Sovia* 3332 (PE 200005595).

31. *Piper submultinerve* C. DC., Notizbl. Bot. Gart. Berlin-Dahlem 6: 480 (1917). (Fig. 30)

Dioecious, slender to stout climber, plants look very similar to *P. betle* in fragrance, branching type, epiphytic branch rooting at node, tip, and color and shape of leaves. Stem look like ridged with pinkish-green to reddish-green stripes. Petiole sheathed at base, 0.8–1 cm long; leaf blade thick, undulate by veins, both sides densely scattered pellucid glands, oily-light green to dark green, oblong, 4–13 cm wide, 8–15 cm long; apex

acute to acuminate; base deeply cordate to auriculate or overlapping auriculate; veins 9, abaxially prominent, often pinkish, six basal, two arising alternately from midrib. Male spike pendulous, 4–7 cm long, ca. 0.3 cm in diameter; peduncle 2–3 cm long; bract circular, not stalked; stamens 2, rachis pubescent. Fruiting spike pendulous, 2.5–3.5 cm long; peduncle ca. 3 cm long; drupe globose, embedded densely on rachis. Flowering and fruiting from March to August.

Distribution. Northern Thailand to China, 400–750 m alt.

Specimens examined. THAILAND: Northern, roadside of Mae Sarieng district to Mae Salid district, Mae Hong Son province, 750 m alt., May 15, 2005, *A. Chaveerach* 223 (BK); *China & Sovia* 1252 (PE 200005600, 200005601, 210001676).

32. *Piper sylvaticum* Roxb., Fl. Ind. 1: 158 (1820). (Fig. 31)

Dioecious, creeping on ground, branching shoot erect or ascending, many parts hairy. Stem succulent and procumbent, flexuous. Petiole hairy, 2–5 cm long; leaf blade membranous; leaf blade on creeping branch broadly ovate to circular, leaf blade on branching shoot ovate; leaf blade 6–8 cm wide, 9–11 cm long; apex acuminate; base cordate with rounded lobes; veins 7, abaxially hairy, all basal, one pair reaching leaf apex. Female spike straight up, 1.2–1.5 cm long, ca. 0.5 cm in diameter; peduncle 1.4–1.7 cm long; bract circular, upper convexed; stigmas 3–4. Fruiting spike 1–2 cm long; drupe globose, embedded densely on rachis. Flowering from November to December.

Local name. Plu-din.

Distribution. Northern, North-eastern Thailand to China, Bangladesh, India, Myanmar, 200–1000 m alt.

Specimens examined. THAILAND: Northern, village forests of Chiang Mai province, 300 m alt., July 10, 1998, *A. Chaveerach* 4 (BK 63482); *Bo-sheng Li*

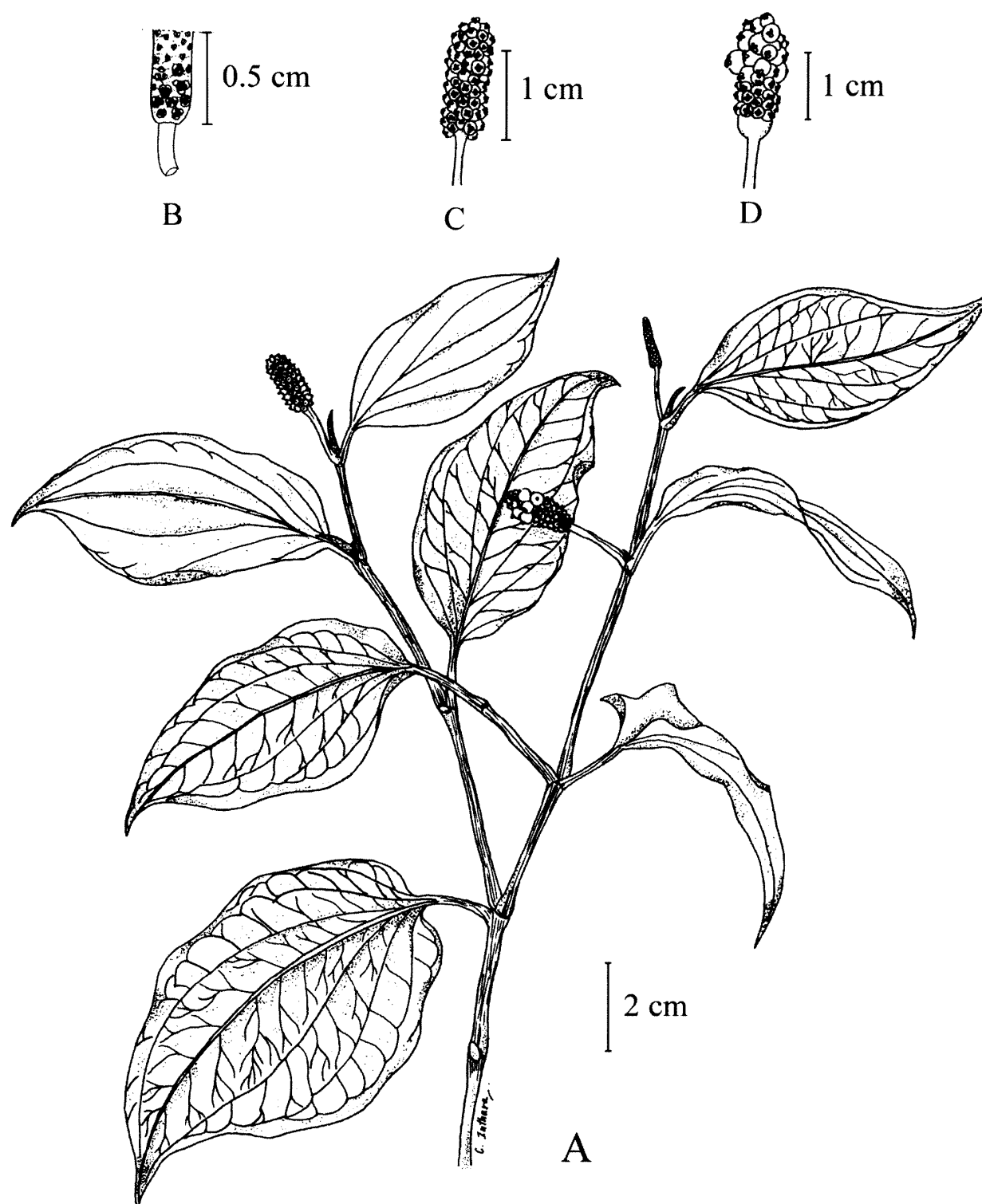


FIG. 28. *Piper sarmentosum* Roxb. A: Branch with flowering and fruiting spikes. B: Part of spike with male and female flowers together. C–D: Fruiting spikes. A. Chaveerach 18 (BK).

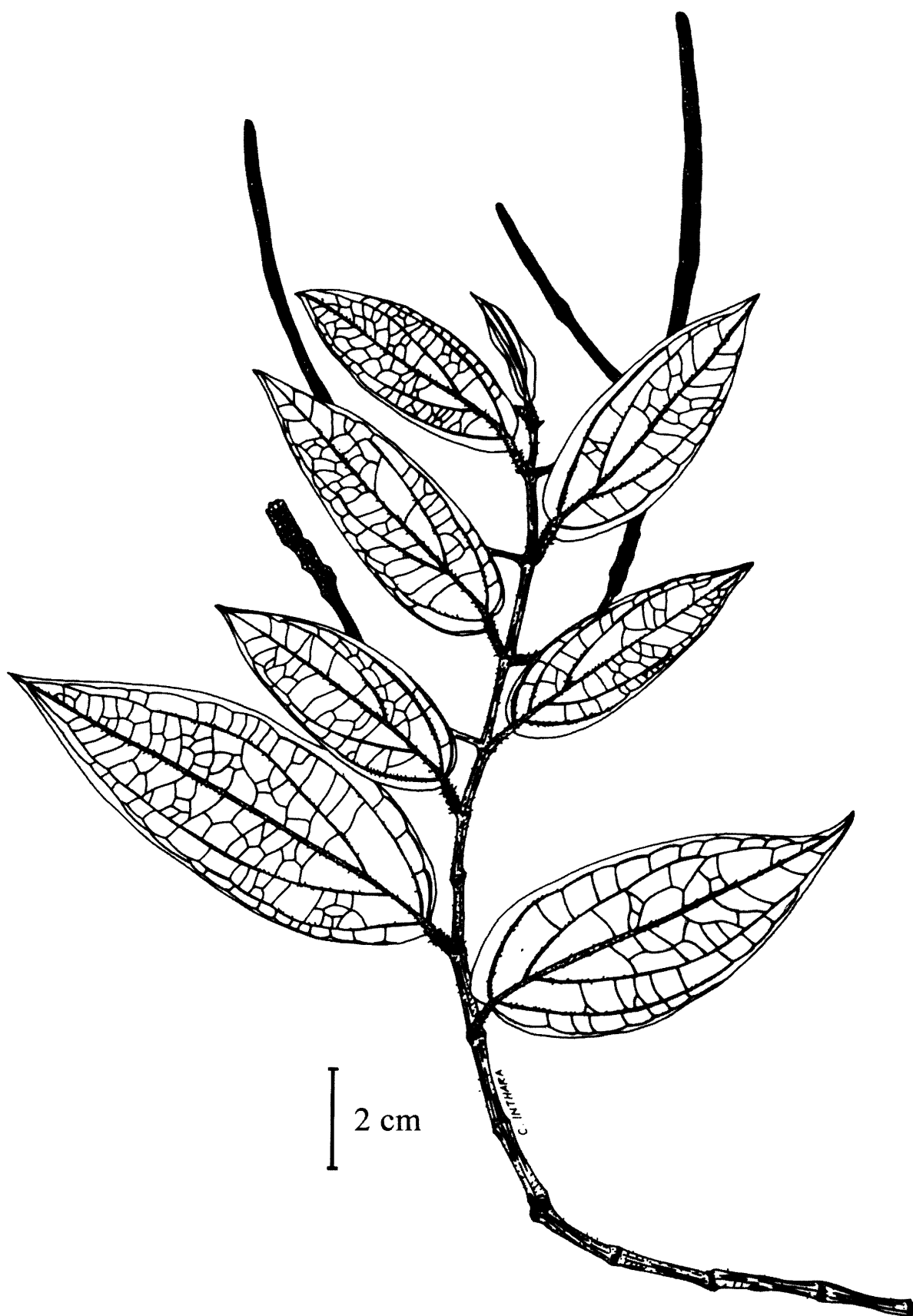


FIG. 29. *Piper semiimmersum* C. DC. Free branch with spikes. A. Chaveerach 115 (BK).

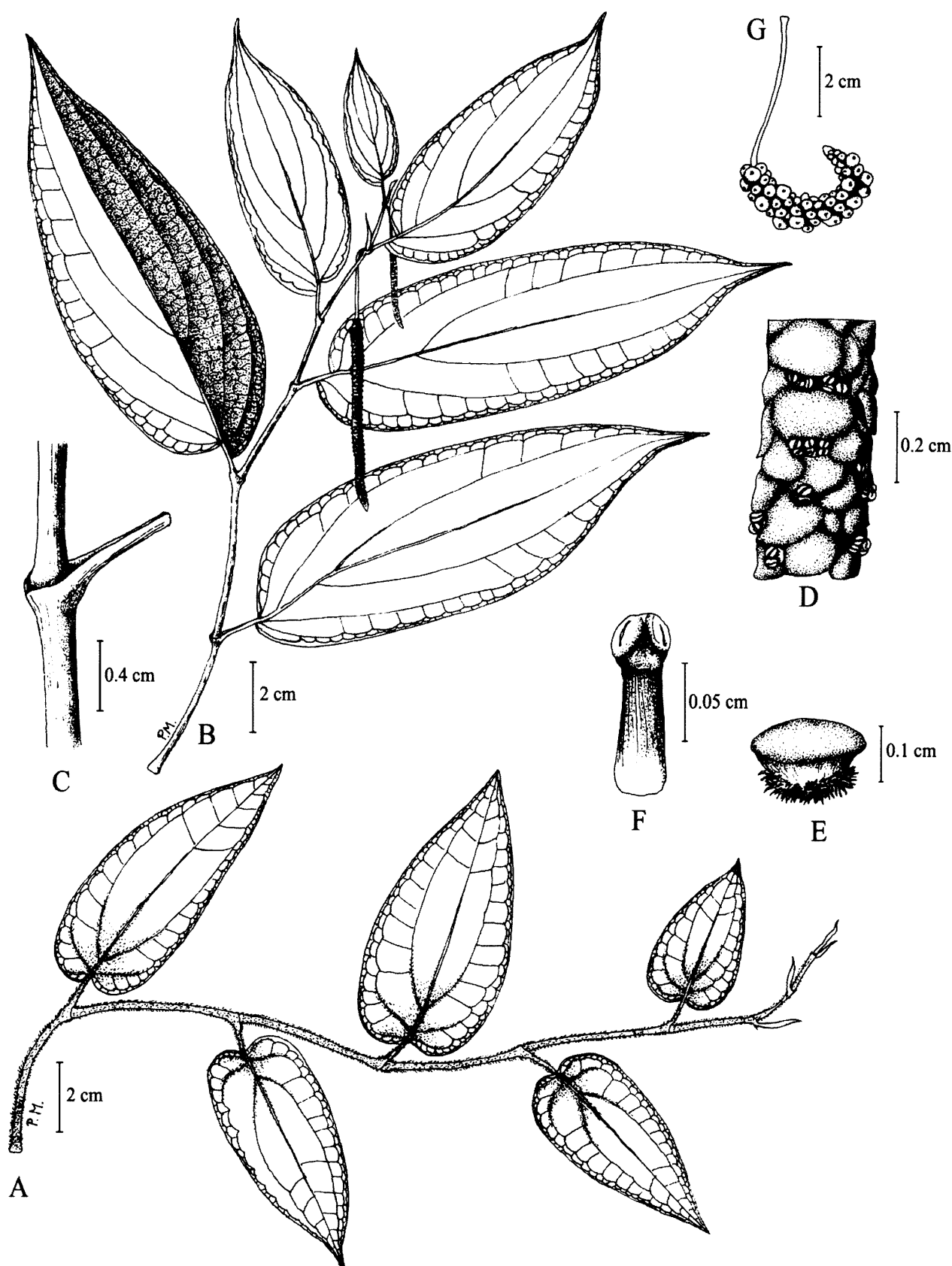


FIG. 30. *Piper submultinerve* C. DC. A: Epiphytic branch. B: Free branch with spike. C: Dilated node. D: Part of male spike. E: Bract. F: Male flower. G: Fruiting spike. A. Chaveerach 223 (BK).

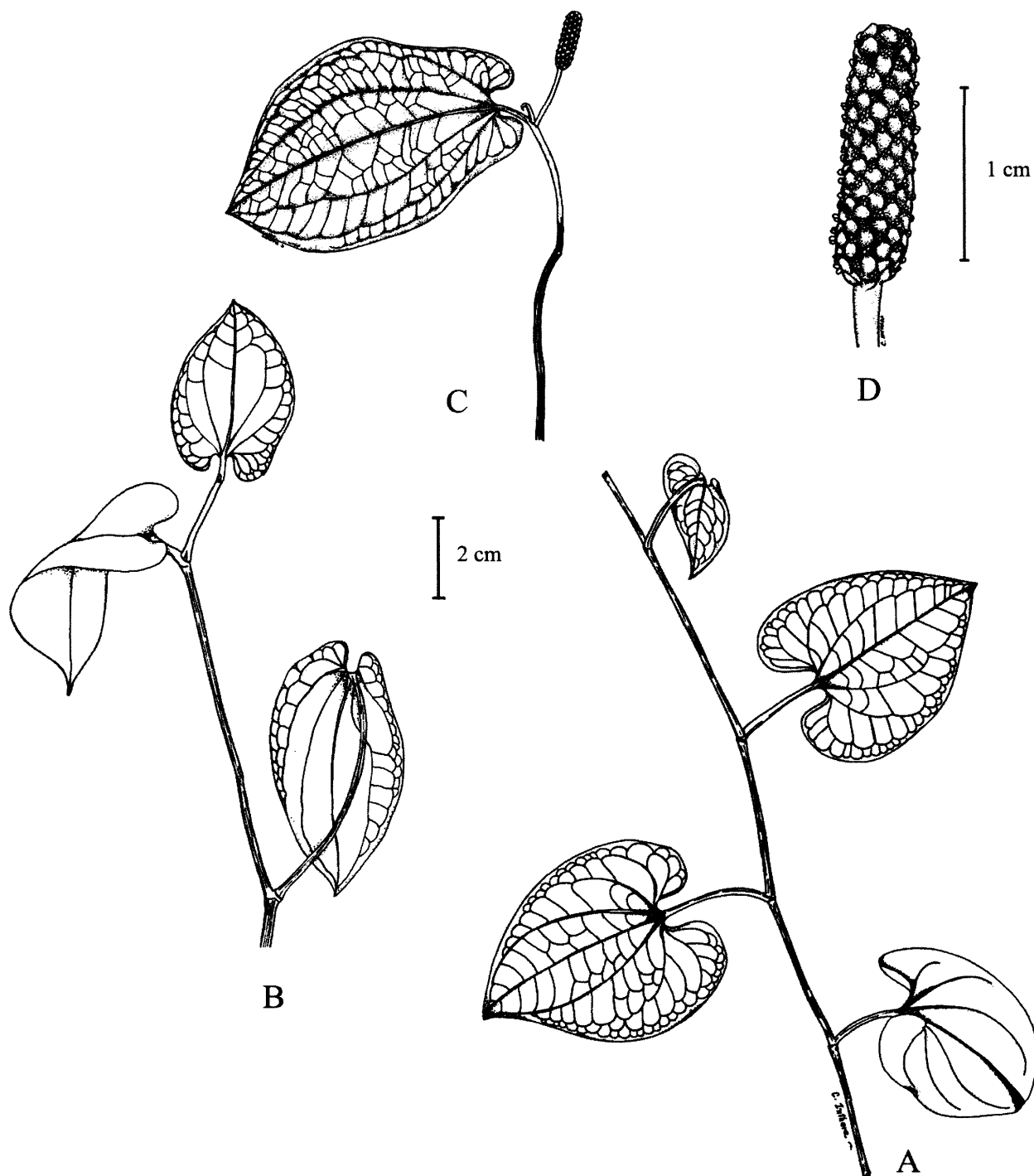


FIG. 31. *Piper sylvaticum* Roxb. A–B: Creeping branches. C: Branch with female spike. D: Female spike. A. Chaveerach 4 (BK 63482).

& Shu-zhi Cheng 2794 (PE 200005602); *J. F. Maxwell BKF 046683, 046709* (BKF).

Note. This species is wild and cultivated throughout the country, young leaves are used for cooking.

33. *Piper sylvestre* Lam., *Ill. Gen.* 1: 79 (1791); Huber, *Rev. Handb. Fl. Ceylon* 6: 280 (1988). (Fig. 32)

P. argyrophyllum Miq., *Syst. Piperac.*: 330 (1844); Thwaites, *Enum. Pl. Zeyl.* 293 (1861).

Monoecious, small shrub, 45–60 cm tall, much branching, glabrous. Petiole 0.5–2 cm long; leaf blade coriaceous, elliptic or lanceolate, 4–7 cm wide, 10–20 cm long; apex acuminate; base slightly oblique; veins 7, two pairs basal, one pair from midrib. Spikes straight up, male flowers on upper part, male and female flowers on lower part, 3.5–12 cm long, 0.2–0.5 cm in diameter; peduncle 1.5–2 cm long; bract orbicular to elliptic; stamens 3. Fruiting spike 8–16 cm long; drupe globose with conical point, sessile, 0.2–0.5 cm in diameter, arranged loosely on rachis, yellow when ripe. Flowering from May to December.

Local name. Sa-kan, Prik-thai-chang.

Distribution. Whole Thailand to Sri Lanka, 100–1200 m alt.

Specimen examined. THAILAND: Eastern, Phu Khieo Wildlife Sanctuary, Chaiyaphum province, 900 m alt., July 11, 1998, *A. Chaveerach* 8 (BK 63486, 63487); *J. F. Maxwell BKF 046691, 089743* (BKF).

34. *Piper thomsonii* (C. DC.) Hook. f., *Fl. Brit. Ind.* 5: 87 (1885). – *Chavica thomsonii* C. DC. in A. DC., *Prodr.* 16(1): 389 (1868).

Monoecious or dioecious, creeping on ground and herbaceous climber, glabrous. Stem slender, glabrous or very finely pubescent, finely ridged when dried, 0.2–0.5 cm in diameter. Creeping branch sparsely hairy. Petiole sparsely hairy, 2–

10 cm long; leaf blade membranous to papery, with pale brownish, yellowish, or pellucid glandules densely scattered abaxially, sometimes also occurs along veins, finely powdery pubescent along abaxial veins, ovate or elliptic, 3.5–7 cm wide, 6–17 cm long; apex short acuminate; base cordate, rounded or oblique; veins adaxially glabrous or sparsely brownish-red glands, abaxially pubescent, 7–9, 5 basal, 3 alternately arising from midrib at 1–5.5 cm apart from base, transversely reticulate veins conspicuous. Epiphytic branch glabrous or very slightly pubescent. Petiole glabrous or very slightly pubescent, 0.5–1 cm long; leaf blade membranous to thinly papery, ovate-lanceolate or elliptic, 3.5–6.5 cm wide, 6–16 cm long, abaxially brownish-red glands densely along veins; apex acuminate; base cuneate, shallowly cordate, rounded or oblique. Veins 7, two pairs basal, one pair arising 2–4.5 cm apart from base, opposite or alternate, reticulate veins conspicuous. Male spike straight up, 1.5–7.5 cm long, 0.1–0.4 cm in diameter; peduncle 0.2–0.5 cm; bract orbicular, peltate or sessile, stalk glabrous or pubescent, adaxially pellucid glandular scattered; stamens 2–4, filament slender, anther reniform. Female spike straight up, cylindrical, 2–2.5 cm long, 0.2–0.5 cm in diameter; peduncle 0.5–1 cm long; bract as in male flower, stigmas 2 or 4 or rarely 3, glabrous or pubescent. Fruiting spike 0.7–1.5 cm long; drupe rather small, globose, embedded on rachis, densely on a spike or loosely interrupted. Flowering and fruiting on year round.

1A. Petiole sheathed at base; stigma 2, glabrous; bract stalk glabrous; drupe densely on a spike

var. *thomsonii*

1B. Petiole non-sheathed; stigma (3–)4, pubescent; bract stalk pubescent; drupe loosely interrupted

var. *trichostigma*

34A. var. *thomsonii* (Fig. 33)

P. bavinum C. DC., *Annuaire Conerv. Jard. Bot. Genève*

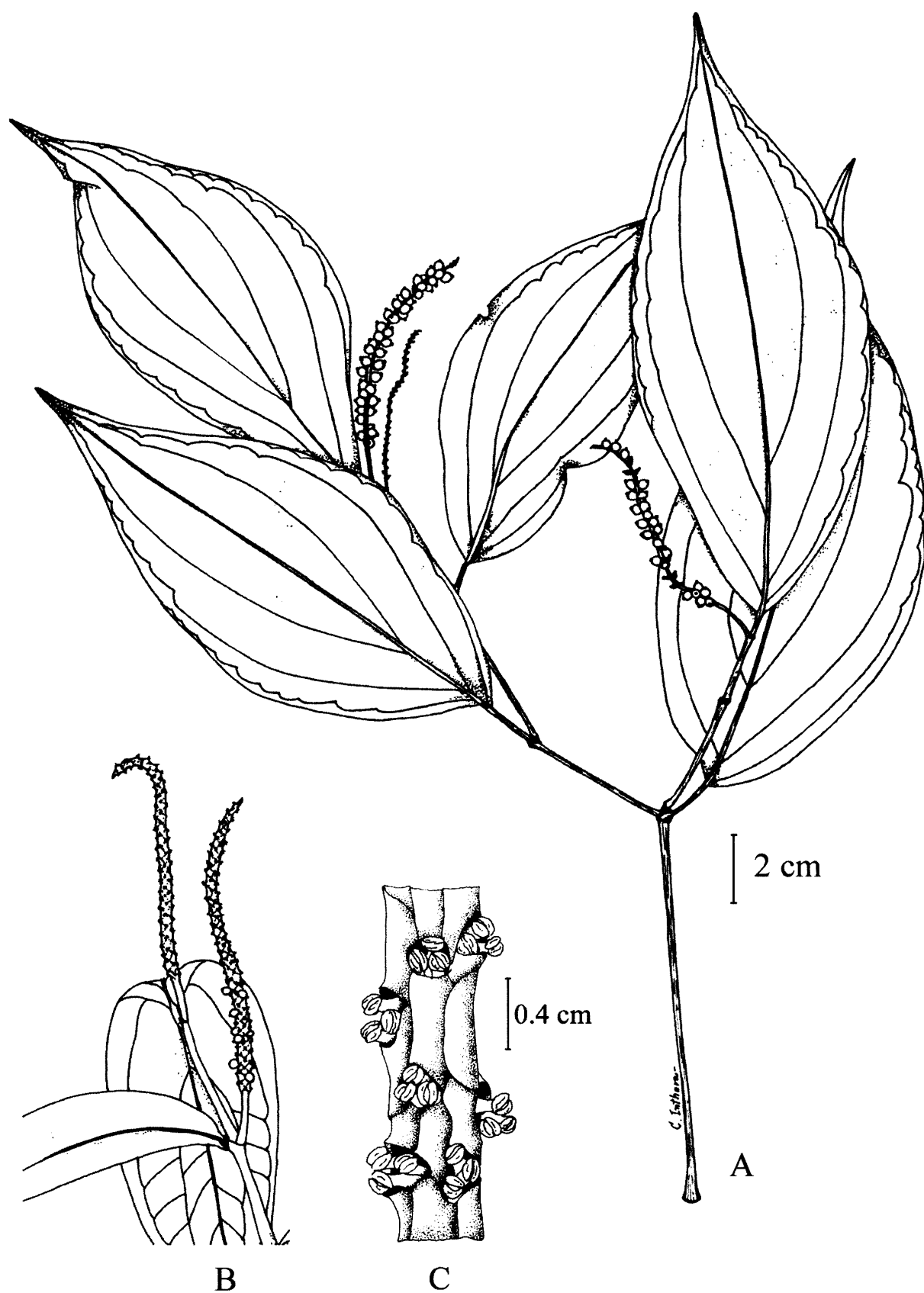


FIG. 32. *Piper sylvestre* Lam. A–B: Branch with fruiting and flowering spikes. C: Part of male spike. A. Chaveerach 8 (BK 63486).

2: 270 (1898), teste Y. C. Tseng *et al.* (1999).

P. punctulivenum C. DC. in Lecomte, Fl. Indo-Chine 5: 77 (1910), teste Y. C. Tseng *et al.* (1999).

P. punctulivenum var. *parvifolium* C. DC. in Lecomte, Fl. Indo-Chine 5: 77 (1910), teste Y. C. Tseng *et al.* (1999).

Monoecious or dioecious, stem finely ridged when dried, 0.2–0.4 cm in diameter. Petiole sparsely hairy, sheathed at base, 5–10 cm long; leaf blade papery, ovate, 3.5–6.5 cm wide, 6–16 cm long; apex short acuminate; base cordate or rounded. Male spike 1.5–5 cm long, 0.1–0.2 cm in diameter; bract orbicular peltate with stalk glabrous or sessile; stamens 2–4. Female spike 2–2.5 cm long, 0.2–0.3 cm in diameter; stigmas 2, glabrous. Drupe densely on a spike. Flowering and fruiting on year round.

Distribution. Whole Thailand to China, Bhutan, India, Vietnam, 100–2100 m alt.

Specimen examined. THAILAND: North-eastern, Phu Luang Wildlife Sanctuary, Loei province, 900 m alt., December 23, 2003, *A. Chaveerach* 59 (BK); *Bo-sheng Li & Shu-zhi Cheng* 1592 (PE 200005606); *Bo-sheng Li & Shu-zhi Cheng* 4556 (PE 210001679); *Yumin Shui* 918 (PE 200005605).

34B. var. *trichostigma* Chaveer. & Sudmoon, *Acta Phytotax. Geobot.* 58(1): 35–37, fig. 3 (2007).

Dioecious, stem slender, glabrous, 0.3–0.5 cm in diameter. Petiole glabrous, not sheathed at base, 2–2.5 cm long; leaf blade membranous to thin papery, elliptic, 4–7 cm wide, 13.5–17 cm long; apex acuminate; base oblique. Male spike 5–7.5 cm long, 0.25–0.4 cm in diameter; bract orbicular peltate, stalk pubescent, adaxially pellucid glandular scattered; stamens 2. Female spike 2–2.5 cm long, 0.4–0.5 cm in diameter; stigma (3–)4, pubescent. Drupe loosely interrupted. Flowering and fruiting depend on habitat, on April to June at Mae Hong Son province; on October at Loei province; on December at Nan province.

Local name. Plu-mae-sarieng.

Distribution. Northern to Northeastern Thailand, 700–1200 m alt.

Specimens examined. THAILAND: Northern, Mae Hong Son province, the roadside of Mae Sarieng district to Mae Salid district, 700 m alt., May 19, 2001, *A. Chaveerach* 49 (BK 63516, 63719); Northern, Nan province, Doi Phu Ka National Park, 1200 m alt., May 19, 2002, *A. Chaveerach* 229 (BK); Northern, Tak province, Taksin Maharat National Park, 900 m alt., May 21, 2002, *A. Chaveerach* 240 (BK); Northeastern, Loei province, Phu Luang Wildlife Sanctuary, 900 m alt., May 22, 2002, *A. Chaveerach* 251 (BK).

35. *Piper tricolor* Y. C. Tseng, *Acta Phytotax. Sin.* 17(1): 35 (1979). (Fig. 34)

Dioecious, stout climber, fragrance much alike *P. betle*. Stem finely striate when dried. Epiphytic branch roughly pubescent, rooting at node; petiole 4–5 cm long; leaf blade thick papery, pale green or whitish, ovate, 2.5–4.5 cm wide, 8–12 cm long; apex acuminate; base cordate or rounded; veins adaxially glabrous, abaxially sparsely hispid. Free branch glabrous; petiole 1–1.2 cm long; leaf blade thick coriaceous papery, broadly lanceolate to lanceolate-oblong, 4–8 cm wide, 11–17 cm long; apex acuminate; base truncate, rounded, or shallowly cordate with equal or unequal lobes; veins 7, abaxially prominent, apical pair arising 0.5–2 cm apart from base, alternate, reaching leaf apex, others basal, reticulate veins raised. Leaves on flowering branches blade abaxially prominently dotted, narrowly ovate, 3.5 cm wide, 8.5–10 cm long; apex acuminate; base rounded or slightly taped, usually oblique. Male spike straight up and curved down, or pendulous, 5.5–7 cm long, 0.2 cm in diameter; peduncle 1.5–2 cm; bract roof-like overlap, circular or nearly so, peltate or short stalk, pubescent, center black surrounded by yellow margin when dried; stamens 2. Flowering from December to April.

Generally, in female plant, dried bract must

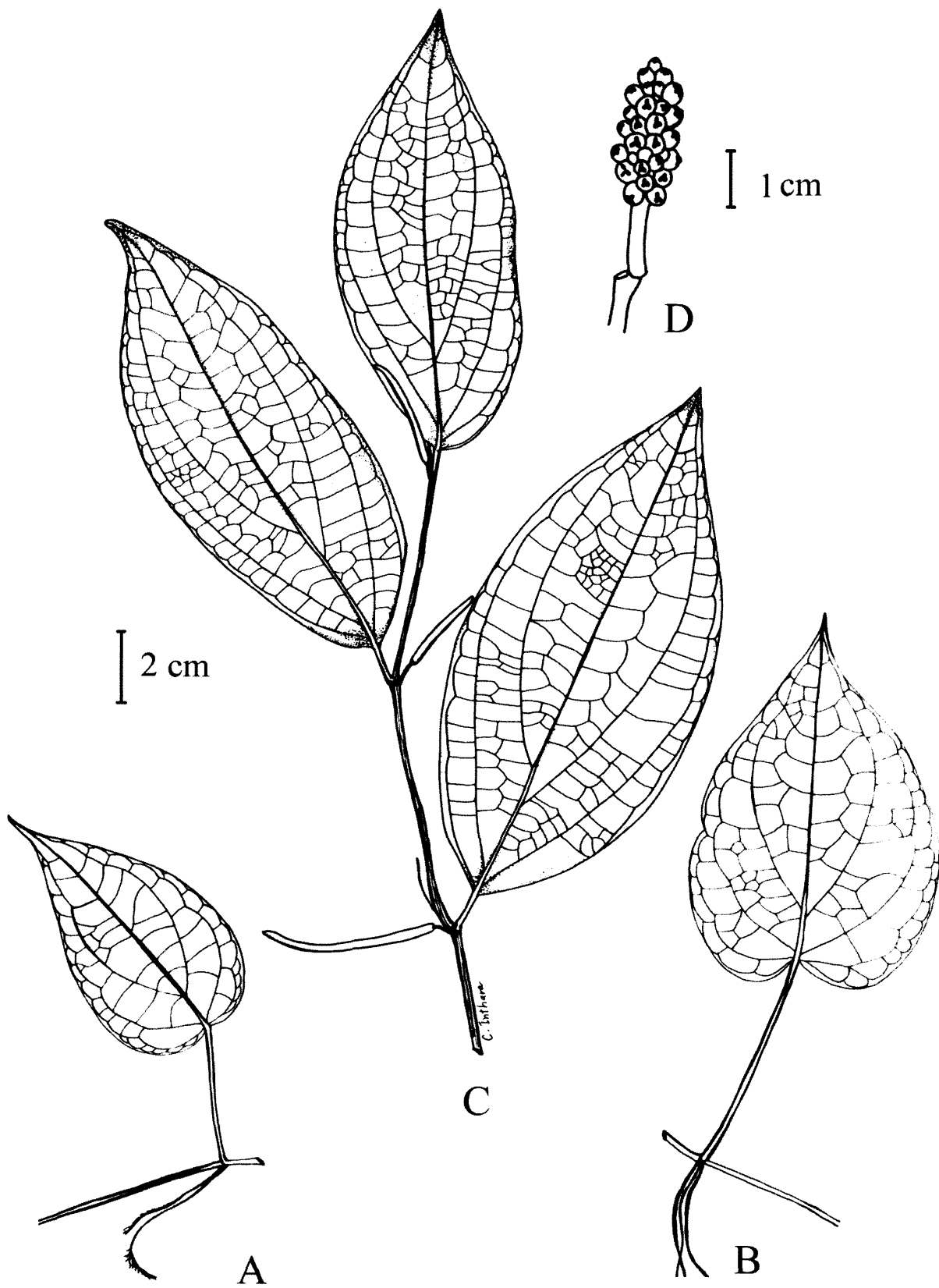


FIG. 33. *Piper thomsonii* (C. DC.) Hook. f. var. *thomsonii*. A–B: Leaves on epiphytic branches. C: Free branch with spike. D: Fruiting spike. A. Chaveerach 59 (BK).

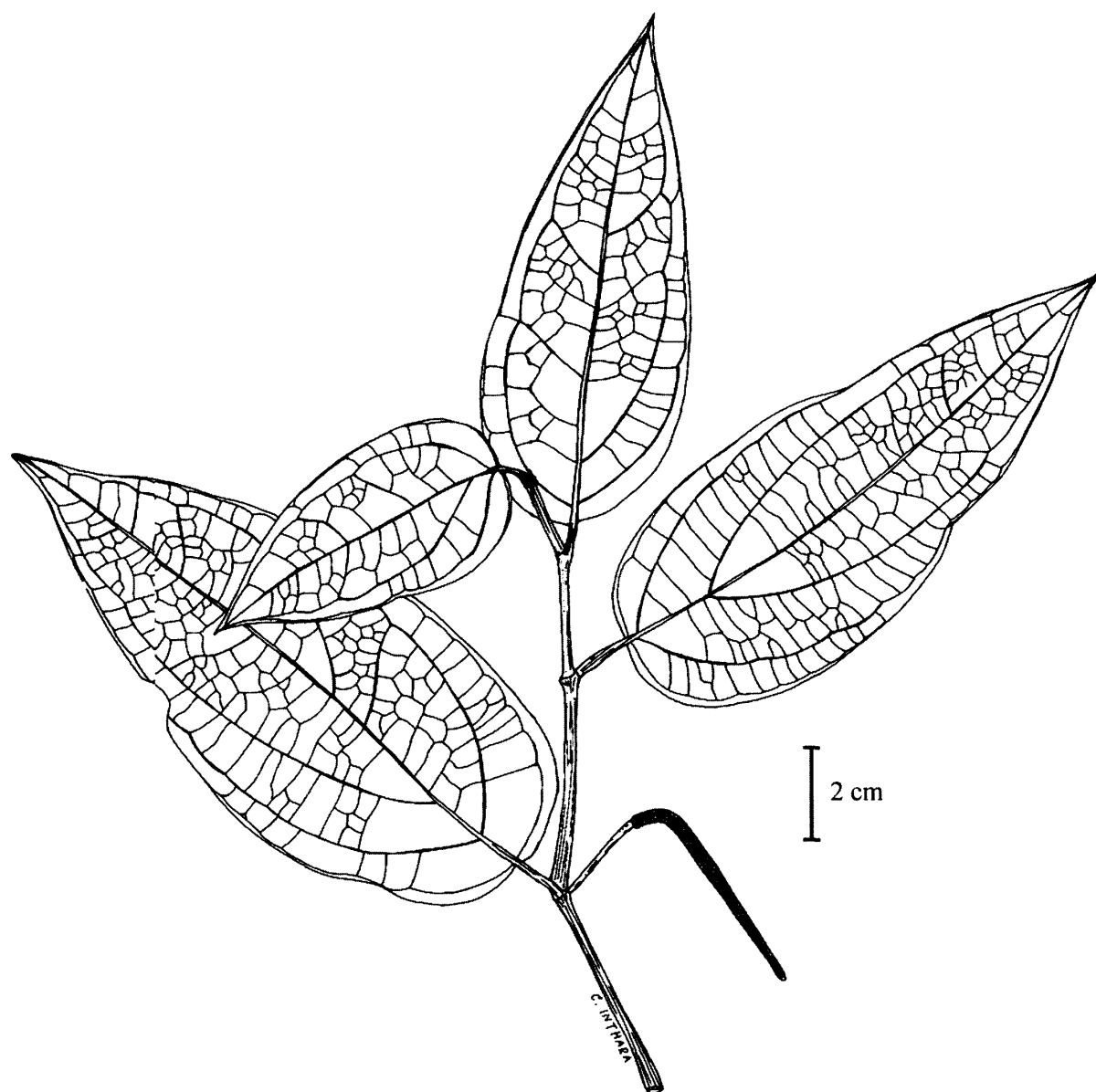


FIG. 34. *Piper tricolor* Y. C. Tseng. Free branch with male spike. A. Chaveerach 64 (BK).

have three different color bands: center black surrounded by white and yellow bands. But the male plant described here has only two bands with all the rest characters identical.

Distribution. Whole Thailand to China, 100–2000 m alt.

Specimen examined. THAILAND: North-eastern, Phu Luang Wildlife Sanctuary, Loei province, 900 m alt., December 24, 2003, A. Chaveerach 64 (BK).

36. *Piper wallichii* (Miq.) Hand.-Mazz., Symb.

Sin. 7: 155 (1929). – *Chavica wallichii* Miq., Syst. Piperac. 2: 254 (1843). (Fig. 35)

P. aurantiacum Wall. ex C. DC. in A. DC., Prodr. 16(1): 357 (1869), nom. illeg..

P. henryei C. DC., Annuaire Conserv. Jard. Bot. Genève 2: 271 (1898), teste Y. C. Tseng *et al.* (1999).

P. martinii C. DC., Notul. Syst. (Paris) 3: 41 (1914), teste Y. C. Tseng *et al.* (1999).

P. ichangense C. DC., Notizbl. Königl. Bot. Gart. Berlin-Dahlem 6: 480 (1917), teste Y. C. Tseng *et al.* in Fl. China 4: 126 (1999).

P. emeiense Y.C. Tseng, Acta Phytotax. Sin. 24(5): 385

(1986), teste Y. C. Tseng *et al.* (1999).

Monoecious, creeping on ground and climbing on trees. Stem glabrous rooting at node. Petiole 0.3–1.5 cm long; leaf blade coriaceous, ovate or lanceolate, 3–4.5 cm wide, 5–8 cm long, leaves on epiphytic branches blade longer; apex acute; base truncate, oblique or cordate; veins 7, two pairs basal, one pair arising 1–1.5 cm apart from base. Male spike straight up and curve down or pendulous, 1.5–6 cm long, 0.1–0.2 cm in diameter; peduncle ca. 1 cm long; bract orbicular; stamens 3. Female spike ca. 5 cm long, ca. 0.2 cm in diameter; stigmas 3. Fruiting spike drooping, 8–15 cm long; drupe globose, arranged loosely on rachis. Flowering on year round.

Local name. Cha-plu-pa, Ja-kan-khao, Plugae, Plu-ka-toi, Sa-kan-nu.

Distribution. Whole Thailand to China, Bangladesh, India, Nepal, 800–2500 m alt.

Specimens examined. THAILAND: Eastern, Phu Khieo Wildlife Sanctuary, Chaiyaphum province, 900 m alt., September 6, 2004, *A. Chaveerach* 91 (BK); *Xian-jin Yang* 7751 (PE 200005609).

Note. This species is always used for traditional medicine in Thailand.

37. *Piper wangii* M. G. Gilbert & N. H. Xia, *Novon* 9 (2): 197 (1999). (Fig. 36)

Dioecious, climber, many parts glabrous. Stem finely striate or ridged and furrowed. Petiole sparsely short hairy extended to abaxially leaf base, 1–2 cm long; leaf blade papery, broadly elliptic to ovate, 4.5–8.5 cm wide, 10–14 cm long; apex acute to acuminate; base cuneate, rounded or shallowly cordate with lobes unequal; veins 7 or 9 but not prominent, two or three pairs basal, apical pair arising 1–1.5 cm apart from base, reaching leaf apex, reticulate veins conspicuous, densely finely glands. Female spike 1–2 cm long, 0.1–0.2 cm in diameter; peduncle 1–1.5 cm long; bract peltate, stalk very short and pubescent; stigmas 3–

4. Fruiting spike 1.5–2.5 cm long; drupe globose, ca. 0.2 cm in diameter, embedded on rachis. Flowering and fruiting from September to December.

Distribution. Northern Thailand to China, 200–1100 m alt.

Specimen examined. THAILAND: Northern, Phitsanulok province, cultivated in villages, 500 m alt., September 3, 2004, *A. Chaveerach* 86 (BK).

38. *Piper yinkiangense* Y. C. Tseng, *Acta Phytotax. Sin.* 17(1): 33 (1979). (Fig. 37)

Stout climber, all parts visibly hairy, light green. Young stem red-green stripes, mature stem light green, furrowed when dried, densely hispidulous. Leaf blade look membranous and delicate, but really slightly thick, light green, densely finely brownish or yellowish glands, adaxially sparsely scattered. Leaves on epiphytic branches petiole 1.5–2 cm long; leaf blade narrowly ovate, 4–5 cm wide, 7–12 cm long; apex acute; base cordate. Leaves on free branches petiole densely hispidulous, 0.7–1.5 cm long; leaf blade ovate, 7–10 cm wide, 12–18 cm long; apex cuspidate; base cordate with lobes unequal. Veins 9, abaxially densely hairy on midrib and sparsely along veins, apical pair arising 2–4 cm apart from base, alternate, reaching leaf apex, reticulate veins conspicuous. Spike wilted, however, the dominant species-specific characters, hispidulous or hairy plants and leaf base obliquely auriculate-cordate, are sufficient for identifying this plant. Wilted flowers were seen on May.

Distribution. Northern and Southern Thailand to China, 100–1000 m alt.

Specimen examined. THAILAND: Peninsula, Khao Sok National Park, Surat Thani province, 100 m alt., October 21, 2004, *A. Chaveerach* 133 (BK).

39. *Piper* sp. 1. (Fig. 38)

Stout climbers, densely pubescent. Petiole densely

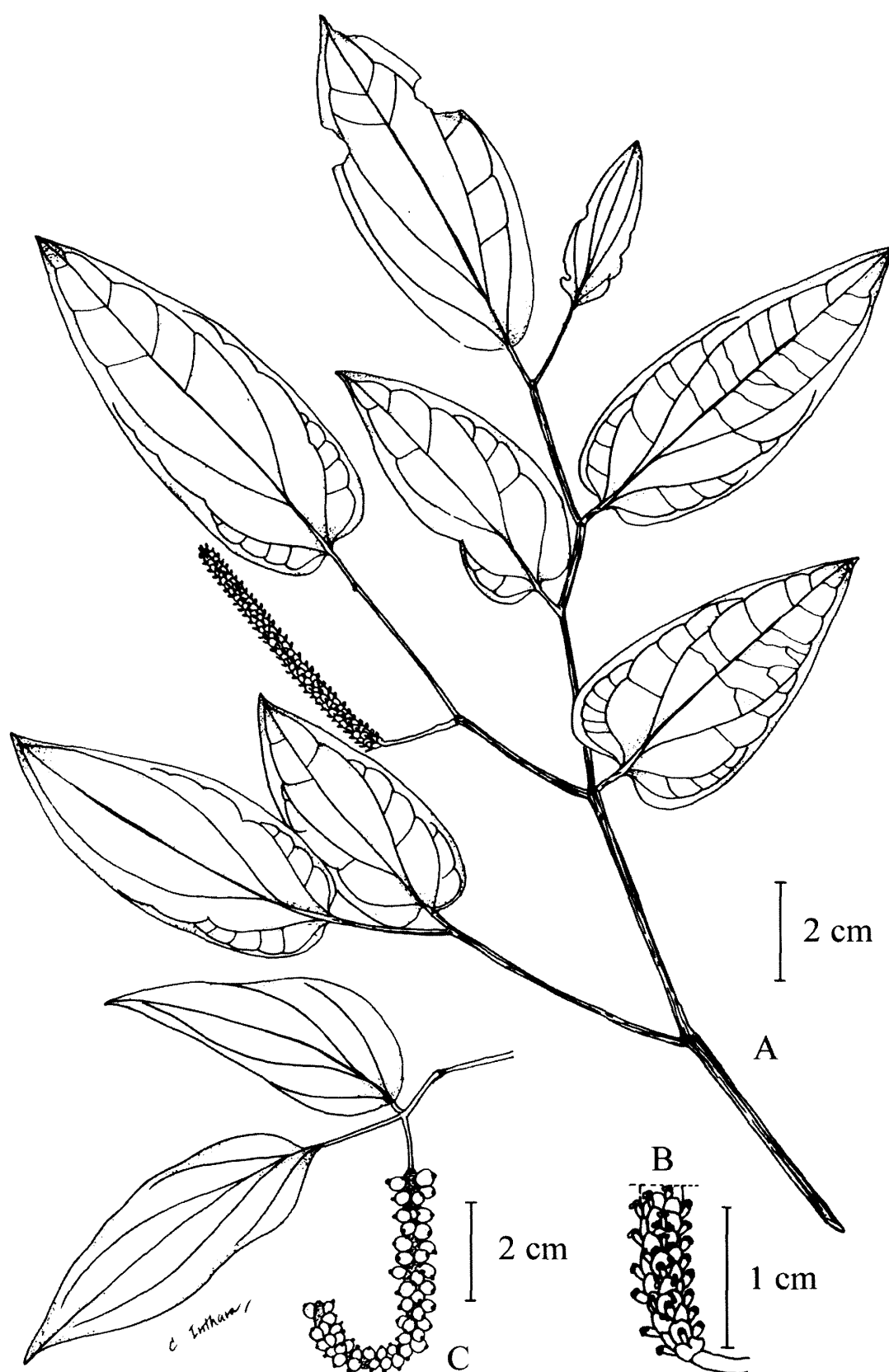


FIG. 35. *Piper wallichii* (Miq.) Hand.-Mazz. A: Free branch with spike. B: Part of spike. C: Branch with fruiting spike. A. Chaveerach 91 (BK).

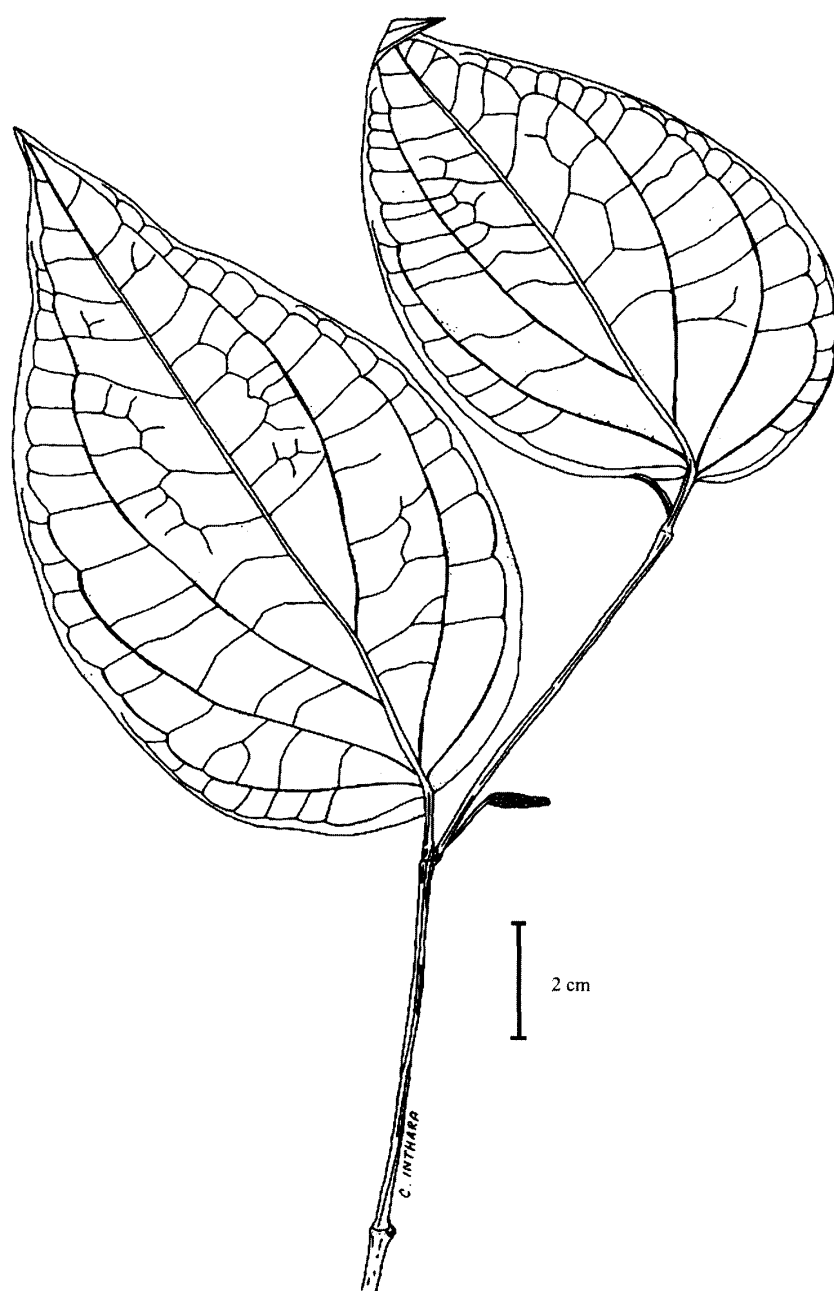


FIG. 36. *Piper wangii* M. G. Gilbert & N. H. Xia. Branch with male spike. A. Chaveerach 86 (BK).

pubescent, 1–2 cm long; leaf blade finely yellowish-brownish glands, yellowish-green when dried, subobovate or oblong-elliptic, 6–13 cm wide, 17–27 cm long; apex cuspidate; base cordate with unequal lobes; veins conspicuous, adaxially glabrous, abaxially pubescent and prominent, two or three basal, others arising from midrib at regular interval of base to apex, reaching leaf apex, reticulate veins conspicuous and transverse. Spikes not seen.

Distribution. Southern Thailand, 100–300 m alt.

Specimen examined. THAILAND: Peninsula, Sri Phang Nga National Park, Phang Nga province, 100–300 m alt., October 19, 2004, A. Chaveerach 98 (BK).

40. *Piper* sp. 2. (Fig. 39)

Climbers and often seen large creeping, glabrous, polymorphic leaf shapes. Creeping branch slen-

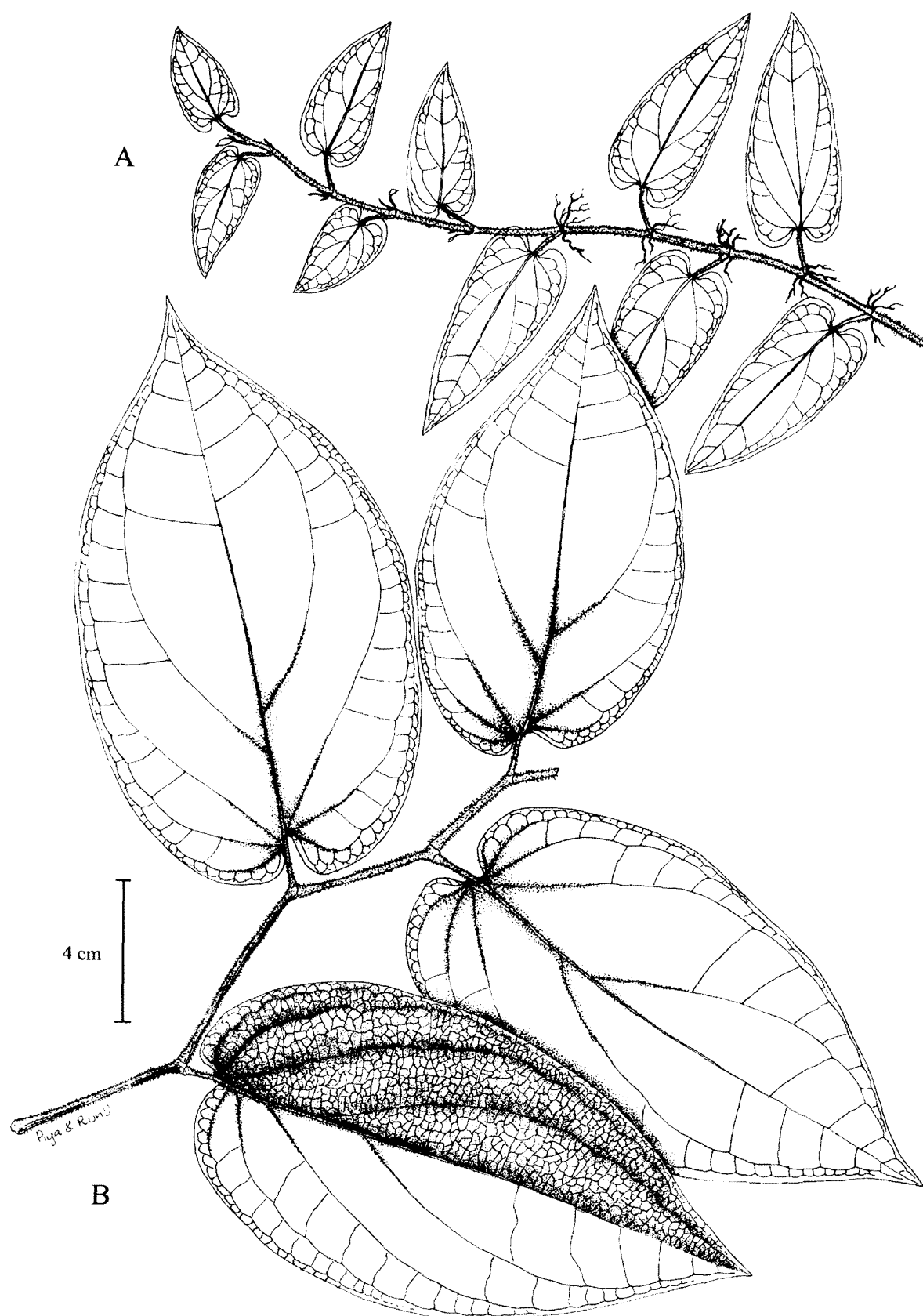


FIG. 37. *Piper yinkiangense* Y. C. Tseng. A: Epiphytic branch. B: free branch. A. Chaveerach 133 (BK).



FIG. 38. *Piper* sp. 1. Epiphytic branch. A. Chaveerach 98 (BK).

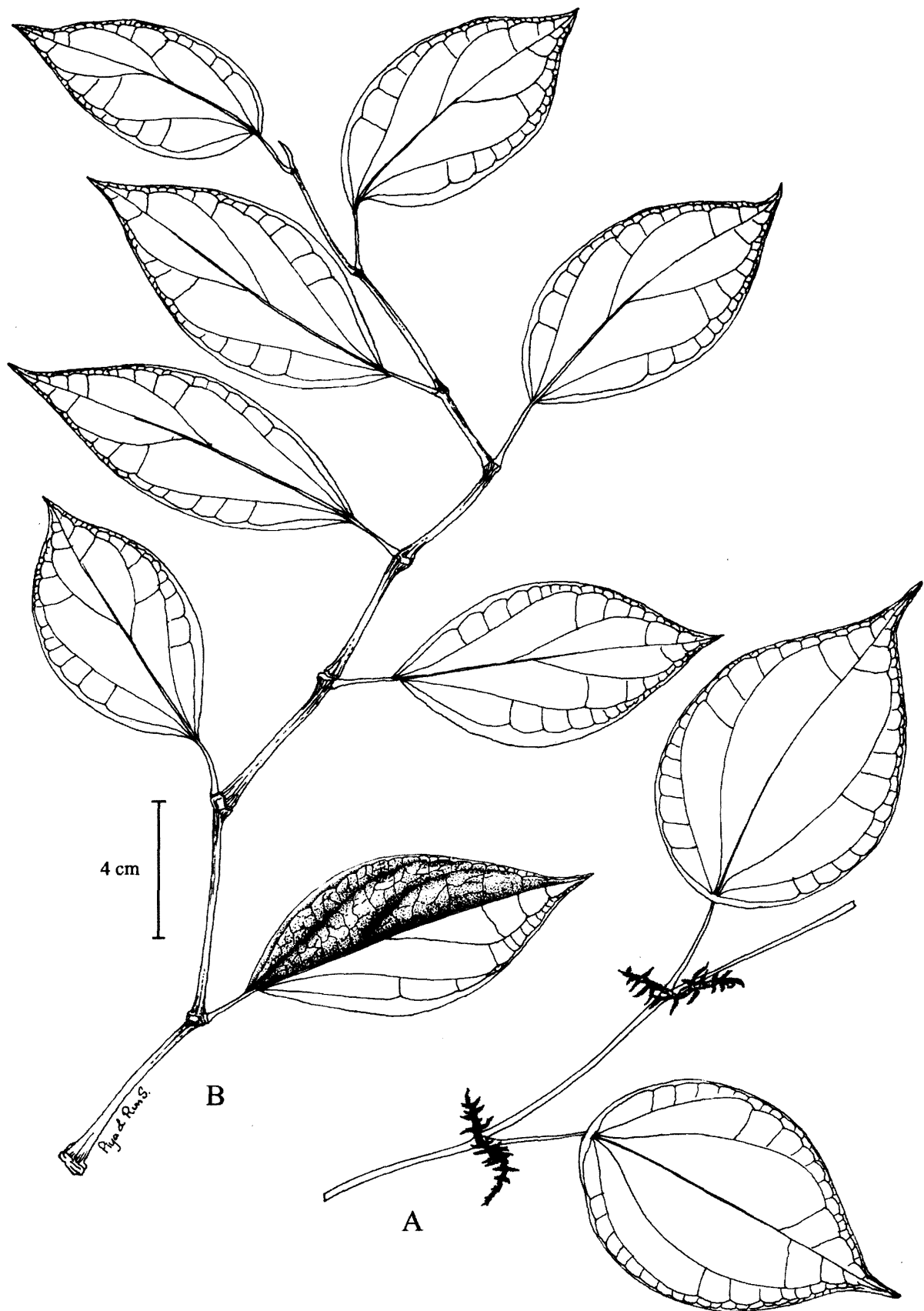


FIG. 39. *Piper* sp. 2. A: Epiphytic branch. B: Free branch. A. Chaveerach 100 (BK).

der, looking pump, often pinkish-dotted, densely hairy; petiole densely hairy, 3.5–4 cm long; leaf blade thick coriaceous, brownish-yellow and pellucid glands, broadly ovate, 6–7 cm wide, 7–8.5 cm long; apex cuspidate; base shallowly or deeply cordate with lobes divergent; veins 7, sparsely hairy or glabrous, apical pair arising 0.5–0.7 cm apart from base, opposite, reaching leaf apex, others basal, reticulate veins inconspicuous. Epiphytic branch slender; petiole 3–3.2 cm long; leaf blade broadly elliptic, 7–7.5 cm wide, 11 cm long; apex cuspidate; base rounded; veins 7, apical pair looks like arising from midrib, but basal and parallel of midrib 0.5–1 cm apart from base then separate out reaching leaf apex, others basal, reticulate veins inconspicuous. Free branch slender, node joint, swollen; petiole 1–1.5 cm long; leaf blade thick, elliptic, 4–6 cm wide, 9.5–11 cm long; base subcuneate-cuneate; apex acuminate-cuspidate; veins 7, apical pair arising 2.5–5 cm apart from base, alternate, reaching leaf apex. Spikes not seen.

Local name. Sa-kan-look-yai.

Distribution. Southern Thailand, ca. 100 m alt.

Specimen examined. THAILAND: Peninsula, Sri Phang Nga National Park, Phang Nga province, 100 m alt., October 19, 2004, A. Chaveerach 100 (BK).

Note. Its fruit has been used for folk medicine.

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